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GREAT LAKES FORESTRY CENTRE
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Results of forest insect and disease surveys in the NORTHWESTERN REGION of Ontario, 1987

CARRIED OUT BY THE GREAT LAKES FORESTRY CENTRE IN COOPERATION WITH THE ONTARIO MINISTRY OF NATURAL RESOURCES

C. G. Jones and E. J. Czerwinski
Miscellaneous Report No. 77

Canada

THE GREAT LAKES FORESTRY CENTRE

The Great Lakes Forestry Centre is one of six regional establishments located across Canada and operated by the Canadian Forestry Service. The overall objective of the Service is to promote the preservation, enhancement and wise use of a healthy, attractive and bountiful forest resource and terrestrial environment for the economic and social benefit of all Canadians. The Centre pursues this objective by conducting two major programs: research and technical services and forestry development. Both programs address major problems affecting forest management and the forest environment primarily in Ontario, but because of the transprovincial nature of the forest resource, many elements of our research program are of national significance.

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92-05204/

RESULTS OF FOREST INSECT AND DISEASE SURVEYS IN THE NORTHWESTERN REGION OF ONTARIO, 1987

(FOREST DISTRICTS: RED LAKE, SIOUX LOOKOUT, KENORA, DRYDEN, IGNACE AND FORT FRANCES)

C.G. JONES and E.J. CZERWINSKI

GREAT LAKES FORESTRY CENTRE
CANADIAN FORESTRY SERVICE
GOVERNMENT OF CANADA

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SURVEY HIGHLIGHTS

This report reviews the more important insect, disease and abiotic conditions encountered during aerial and ground surveys of the forested areas in the Northwestern Region in 1987.

The total area of moderate-to-severe defoliation caused by the spruce budworm was 3,550,907 ha, a slight increase over the previous year. Egg-mass samples from 147 locations indicate recurring high populations for 1988. The area within which whole-tree mortality of balsam fir occurred increased to 288,608 ha. Sandbar and Ojibway provincial parks were aerially sprayed against spruce budworm by the Ontario Ministry of Natural Resources (OMNR) with the insecticide *Bacillus thuringiensis (B.t.)*.

The area moderately to severely infested by the jack pine budworm decreased by 68% from the previous year to 504,749 ha and results of the modified infestation forecast indicate light defoliation for 1988 in most areas previously infested. An additional 2,000 ha of top mortality and whole-tree mortality were mapped in Red Lake District and 105,463 ha of crown forests were aerially sprayed against the jack pine budworm by OMNR with the insecticide *B.t.*

Medium-to-heavy infestations of the forest tent caterpillar were recorded in Fort Frances District after a 6-year absence of the insect.

Dutch elm disease continues to run its course in the region. Increased infections of the western gall rust were encountered and mortality of young red pine caused by a shoot blight was recorded in Sioux Lookout District.

Special surveys done in 1987 include assessments in 12 white spruce plantations for specific insect and disease problems, a collection of 100 white spruce cones from each of two areas and evaluation of the impact of four pests on trees in 11 black spruce seedling seed orchards.

As in previous years, pests in this report are categorized as follows:

Major Insects/Diseases

capable of causing severe injury to or death of living trees or shrubs

Minor Insects/Diseases

capable of causing sporadic or localized injury but not usually a serious threat to living trees or shrubs

Other Forest Insects/Diseases (Tables)

These tables provide information on two types of pest:

(1) those that are of minor importance and have not been shown to cause serious damage to forest trees,

(2) those that are capable of causing serious damage but, because of low populations or for other reasons, did not cause serious damage in 1987.

The valuable assistance and cooperation extended to the authors by OMNR and woods industry personnel during the 1987 field season are gratefully acknowledged.

C.G. Jones
E.J. Czerwinski

Frontispiece

Severe defoliation caused by the jack pine budworm (*Choristoneura pinus pinus* Free.)

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Major Insects

Spruce Budworm, *Choristoneura fumiferana* (Clem.)

The spruce budworm was once again the most destructive forest pest in Ontario although the area infested by high populations decreased by 19% to 7,189,763 ha. The area within which whole-tree mortality of balsam fir (*Abies balsamea* [L.] Mill.) occurred, however, increased by 82,174 ha from the previous year to 14,067,082 ha in 1987. Except for a few small, isolated pockets of moderate-to-severe defoliation totaling 350 ha in Bracebridge District, Algonquin Region, the remaining areas of medium-to-heavy infestation were confined to the North Central and Northwestern regions (Fig. 1). Aerial surveys disclosed 3,638,506 ha and 3,550,907 ha of moderate-to-severe defoliation in the North Central and Northwestern regions, respectively.

Spruce budworm in the Northwestern Region emerged in early May and development was faster than normal. Cool temperatures in the latter part of May failed to slow development significantly. This cold spell resulted in a reduction in food supply in some areas because of shoot mortality on host trees, and caused light budworm mortality (see section on Frost, page 39). Because of the sporadic and varying nature of the frost damage, no noticeable impact on spruce budworm populations is expected.

A slight overall increase of 49,877 ha of medium-to-heavy infestation was recorded in the region, in Ignace, Red Lake and Sioux Lookout districts along the northern leading edge of the area infested previously (Fig. 2). Decreased populations were observed in parts of the districts of Dryden, Fort Frances and Kenora (Table 1).

Table 1. Gross area of moderate-to-severe defoliation by spruce budworm in the Northwestern Region from 1984 to 1987.

	Area of moderate-to-severe defoliation (ha)			
District	1984	1985	1986	1987
Dryden	454,099	952,385	891,997	835,308
Fort Frances	566,831	700,172	542,176	497,579
Ignace	456,526	599,895	530,761	584,322
Kenora	63,314	911,037	906,917	821,074
Red Lake	200	10	200,349	256,167
Sioux Lookout	126,831	240,048	428,830	556,457

NORTHWESTERN ONTARIO

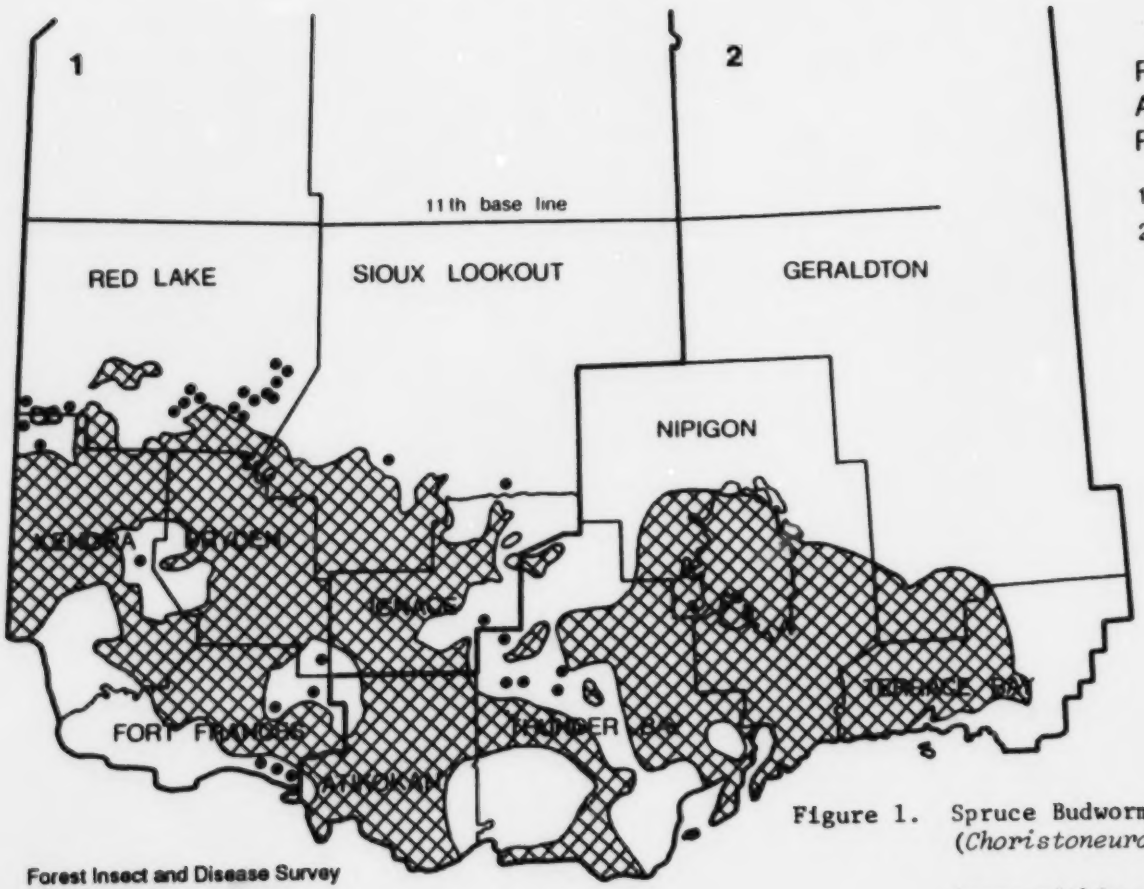

Figure 1. Spruce Budworm (*Choristoneura fumiferana* [Clem.])

Areas within which moderate-to-severe defoliation occurred in 1987 ..... ▨ or •

NORTHWESTERN REGION

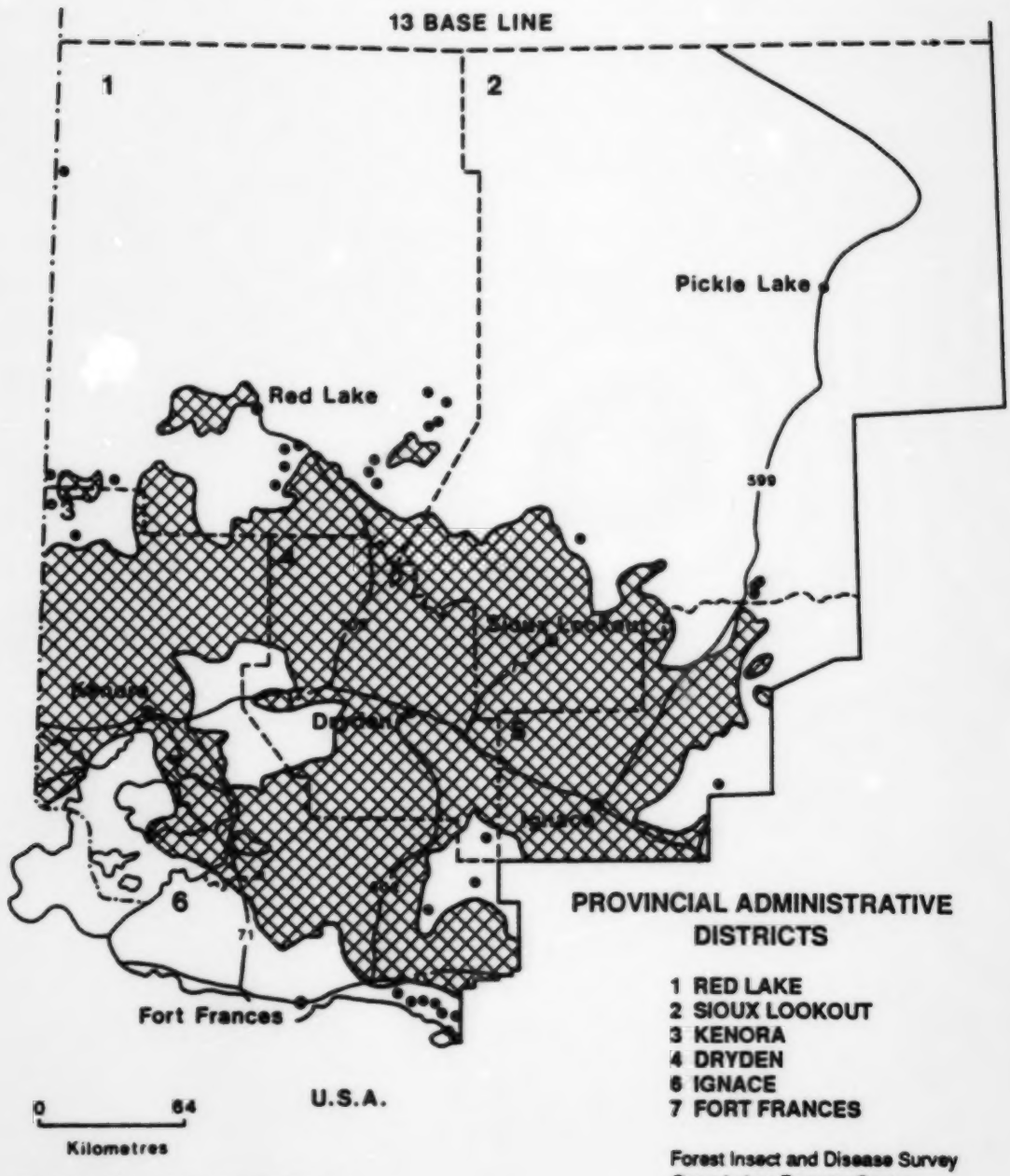

Figure 2. Spruce Budworm
(*Choristoneura fumiferana* [Clem.])

Areas within which moderate-to-severe defoliation occurred in 1987 .... ▨ or ●

Protection sprays were carried out by the Ontario Ministry of Natural Resources (OMNR) in Ojibway Provincial Park, Sioux Lookout District and in Sandbar Provincial Park, Ignace District. The spray operation started on 23 May and was completed the following day. Both parks received a single application of the biological insecticide, *Bacillus thuringiensis (B.t.)*, sprayed from a Bell 206 helicopter. Dipel 132 was applied at a rate of 30 BIU/2.3 L/ha in Ojibway Provincial Park and the experimental *B.t.* formulation Dipel 176 was applied at a rate of 30 BIU/1.6 L/ha in Sandbar Provincial Park. A total of 293 ha was treated at the two locations.

Satisfactory spray results were obtained at both parks. Post-spray assessment disclosed 31% defoliation in the sprayed areas and 88% defoliation in the check plots at Ojibway Provincial Park, and 16% defoliation in the spray plots and 88% defoliation in the check plots at Sandbar Provincial Park.

The results of egg-mass samples taken at 147 locations in the Northwestern Region indicated that the average egg-mass density had decreased by 41% from the previous year. Although increased egg-mass densities were recorded only in the Ignace and Red Lake districts, the average count per 9.29 m^2 of foliage was high enough in the other districts that moderate-to-severe defoliation could be predicted in 86% of the areas sampled (see Appendix, Table A1). Some increases in the area of moderate-to-severe damage are expected along the northern edge of the current line of demarcation, although host availability is limited in much of this area. Increased expansion is likely in pockets of damage north of the main infestation, especially in the Whitemud Lake-Bowerman Township area, Red Lake District. High populations will continue to infest generally the same area infested in 1987 and no major change in the shape of the current infestation is expected in 1988.

In conjunction with the regular egg-mass sampling, a group of three traps has been deployed at 12 egg-mass locations across the region. These traps are part of a nationwide program to develop a relatively inexpensive and efficient tool for monitoring spruce budworm populations. The plastic nonsaturating traps are equipped with a synthetic pheromone lure and a strip impregnated with a killing agent. The results of the trapping program reflect the trend indicated by the conventional system of egg-mass sampling, that there were fewer adults in 1987 than in 1986 and, consequently, fewer egg masses. The number of adults trapped in the region averaged 1265 per location in 1986 and 338 in 1987.

Whole-tree mortality of balsam fir can occur after three to five years of moderate-to-severe defoliation. Balsam fir tree mortality was first reported in the region in 1977 in a 405-ha area of Fort Frances District, after three years of moderate-to-severe defoliation. Since then the area of budworm-associated tree mortality in the region has increased considerably. In 1987 it was 288,608 ha, a 8,411 ha increase over the previous year. Mortality has been recorded in Fort Frances,

Dryden, Kenora and Ignace districts (Fig. 3). The northern limit of mortality occurs south of a line running from Kukukus Lake, Ignace District to the south side of Wabigoon Lake, Dryden District.

Ground checks were conducted at 10 locations, some of which had been monitored for a number of years, to determine the incidence of whole-tree mortality in 1987 (Table 2). The largest increase in mortality at any one plot was recorded at the Kawawia Creek location, where the dead trees increased from 25% in 1986 to 79% in 1987. A plot at Petite Lake, Fort Frances District, was discontinued in 1987 because almost all the host trees on the plot were dead. The average balsam fir tree mortality at locations examined in both 1986 and 1987 increased from 39% in 1986 to 54% in 1987.

Four spruce budworm impact plots were established during the 1986 and 1987 field seasons, two in Dryden District and one in each of Ignace and Sioux Lookout districts. These plots consist of 100 trees each and are similar to a regular mortality plot except that mortality itself was not the only factor considered in plot establishment. The

Table 2. Summary of spruce budworm-associated tree mortality based on ground checks for a five-year period in the Northwestern Region.

Location	Host	Tree mortality (%)				
		1983	1984	1985	1986	1987
Dryden District						
Ingall Lake	bF	2	2	6	6	10
Minnehaha Lake	bF			8	13	31
Fort Frances District						
Eltrut Lake	bF	14	61	48	88	96
Harris Lake	bF	13	42	27	49	55
Kawawia Creek	bF			25	25	79
Manitou Stretch	bF	36	24	55	76	79
Petite Lake	bF	39	67	57	94	[a]
Strong Lake	bF	12	31	15	52	59
Ignace District						
Dimple Lake	bF				8	25
Kenora District						
Forgie Twp	bF	2	3	3	3	5

[a] no longer sufficient living hosts

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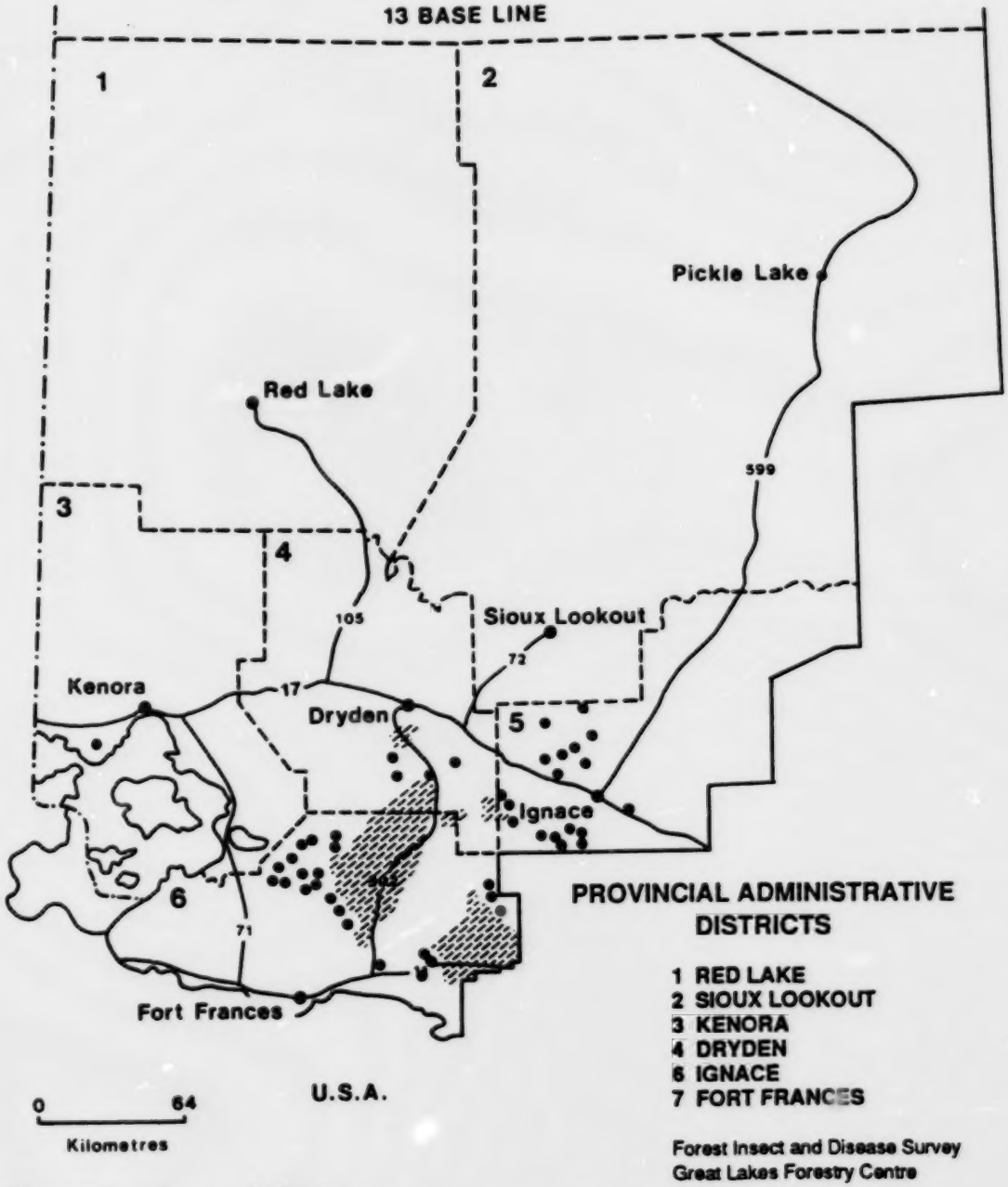


Figure 3. Spruce Budworm
(*Choristoneura fumiferana* [Clem.])

Areas within which balsam fir mortality and top mortality occurred .... ▨ or •

plots reflect differing stand composition: two are located in relatively pure stands of black spruce (*Picea mariana* [Mill.] B.S.P.) and two in a mixed stand of balsam fir (*Abies balsamea* [L.] Mill.), white spruce (*Picea glauca* [Moench] Voss) and black spruce. Quantitative data such as tree species, crown class, diameter, height and amount of top-kill are recorded each year. From the data collected, comparisons in rates of defoliation and mortality can be made between stands of differing species composition and between different tree species within the same stands. As well, the impact on growth and volume can be determined.

Jack Pine Budworm, *Choristoneura pinus pinus* Free.

The current infestation in the region was first detected in 1984 and the accompanying area of moderate-to-severe defoliation totaled 153,378 ha. The infestation peaked in 1986 when 1,554,139 ha of moderate-to-severe damage were reported (Fig. 4).

The area of medium-to-heavy infestation in 1987 declined by 68% from the previous year. Aerial surveys detected 504,749 ha of moderate-to-severe defoliation of jack pine (*Pinus banksiana* Lamb.) in 1987, 1,049,390 ha less than recorded in 1986 (Fig. 5).

The greatest decrease in the area infested occurred in Fort Frances District, where 11,237 ha of moderate-to-severe damage (>25% defoliation), representing an 89% decrease from 1986, were mapped. A large area of current infestation occurred in the central portion of the district, north from the Vane-Strong lakes area to the Manitou Stretch section of Lower Manitou Lake. Table 3 compares the areas of defoliation, by OMNR district, for 1986 and 1987.

The next largest decrease in area infested occurred in Kenora District. Two large pockets of moderate populations (26%-75% defoliation) contributed to the 69,344 ha of damage recorded, a 78% decrease from the previous year. One was observed in the Redditt-Pettypiece townships area and the other on the Aulneau Peninsula.

Surveys revealed 286,949 ha of moderate-to-severe damage, 590,572 ha less than recorded the previous year in Red Lake District. The bulk of the infestation occurred in the Trout-Nungesser-Kirkness lakes area. A large body of moderate defoliation was recorded on the Red Lake-Sioux Lookout district boundary in the Celt-Aerofoil lakes area. Elsewhere, scattered pockets of medium infestation were mapped north from the Kenora and Dryden district borders to the Poplar Hill-McInnes Lake area.

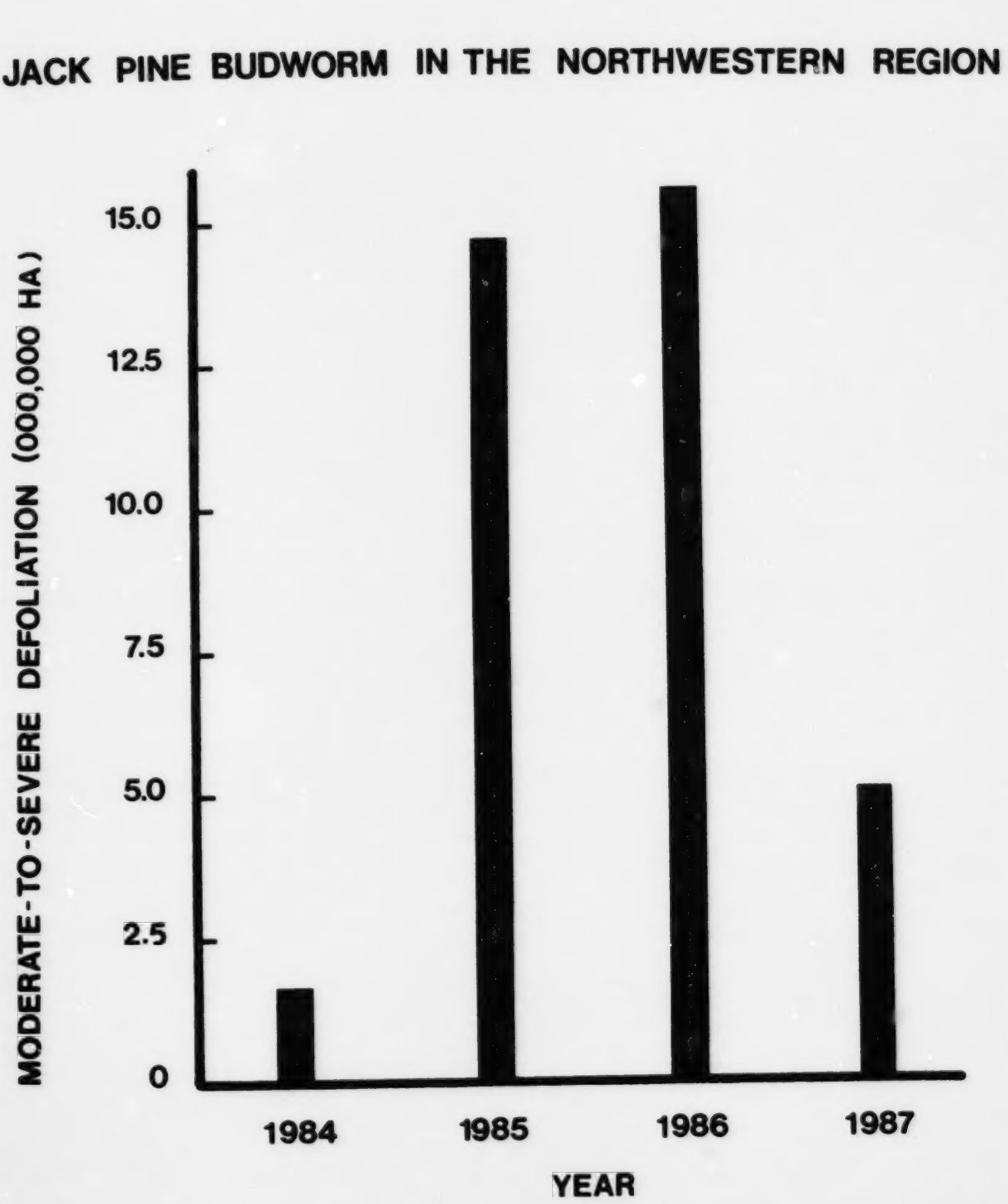


Figure 4. Area of damage caused by the jack pine budworm (*Choristoneura pinus pinus* Free.) over a four-year period in the Northwestern Region.

Table 3. A comparison of the gross area (ha) of moderate-to-severe defoliation by the jack pine budworm in 1986 and 1987 in the Northwestern Region.

District	1986	1987	Change
Dryden	133,653	85,505	-48,148
Fort Frances	99,391	11,237	-88,154
Ignace	37,435	21,194	-16,241
Kenora	315,731	69,344	-246,387
Red Lake	877,521	286,949	-590,572
Sioux Lookout	90,408	30,520	-59,888
Totals	1,554,139	504,749	-1,049,390

Except for the infestation shared with Red Lake District in the Celt-Aerofoil lakes area, only small, scattered pockets of moderate damage were observed in Sioux Lookout District. The total area infested was 30,520 ha, a 66% decline from 1986. The northernmost infestations in the region were recorded in Sioux Lookout District, in the Moose Mountain and Horseshoe lakes areas.

The total area infested in Ignace District decreased from 37,435 ha in 1986 to 21,194 ha in 1987. Moderate defoliation was recorded along Hwy 17 from McNevin Township west to the Dryden-Ignace district border and along Hwy 599 north of Hwy 17 to the Sandbar-Little Sandbar lakes area. Except for damage in the Bark-Basket lakes area the numerous pockets of medium infestation were mapped within a 20-km radius of Hwy 17.

The smallest decrease in area infested occurred in Dryden District where the area of damage recorded in 1986 declined by 36% to 85,505 ha in 1987. Pockets of defoliation were widespread and except for a small area of severe damage (>75% defoliation) near Vermilion Bay, defoliation was moderate.

A significant reduction in the current jack pine budworm outbreak is forecasted for 1988. Several factors have contributed to this forecast.

The pattern and intensity of the current infestation give a visual impression of its decline (Fig. 5). Defoliation decreased in 1987 and only 18% of the infested area was considered severe, a sizable reduction from the previous year when 48% of the area infested was mapped as severe.

Figure 6 compares the last infestation in Northwestern Ontario with the current one and illustrates the natural progression of this particular pest and the similarities between the two infestations. The earlier infestation, which was confined entirely to the Northwestern

NORTHWESTERN REGION

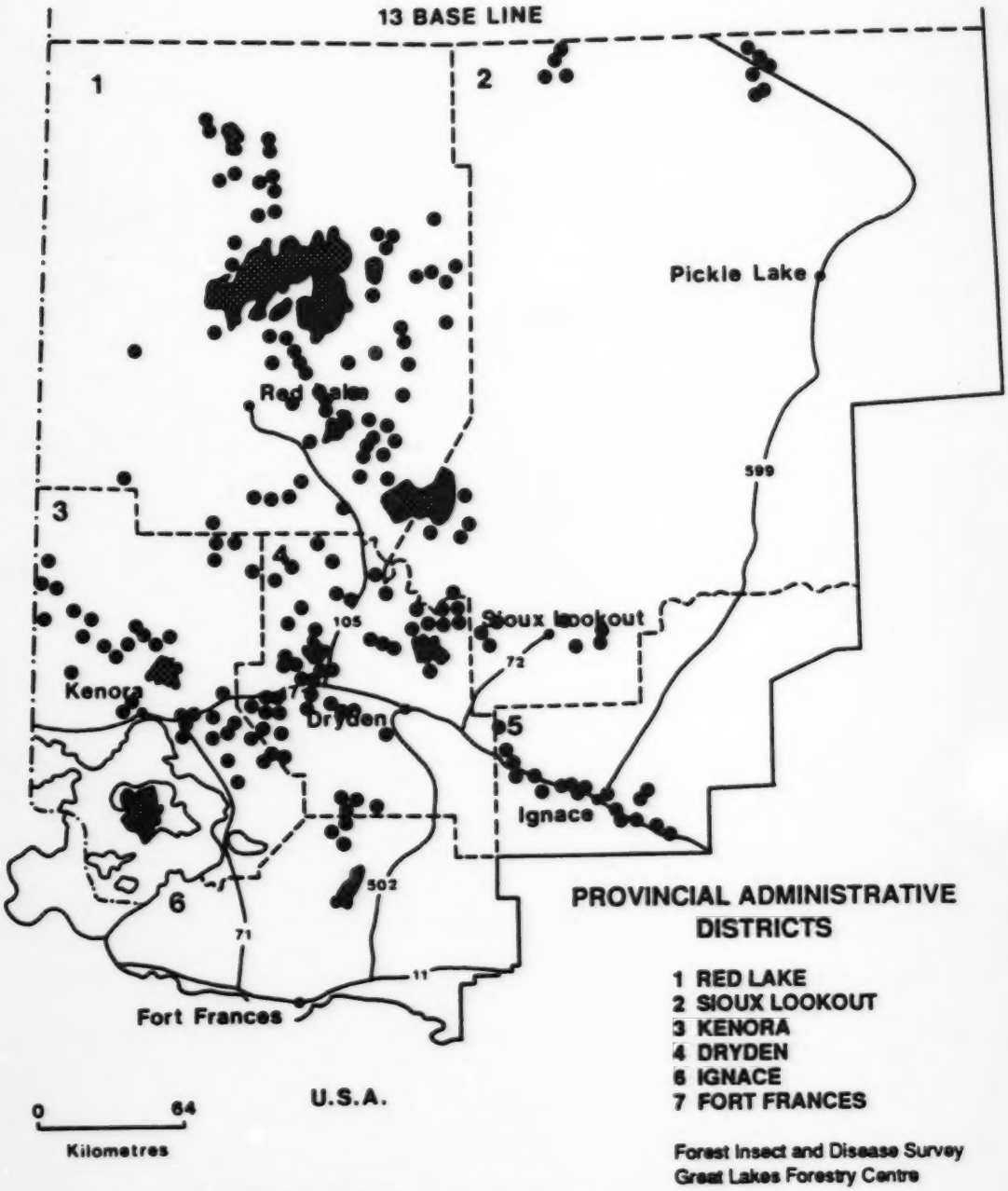


Figure 5. Jack Pine Budworm
(*Choristoneura pinus pinus* Free.)

Areas within which moderate-to-severe defoliation occurred in 1987 ..... ■ or ●

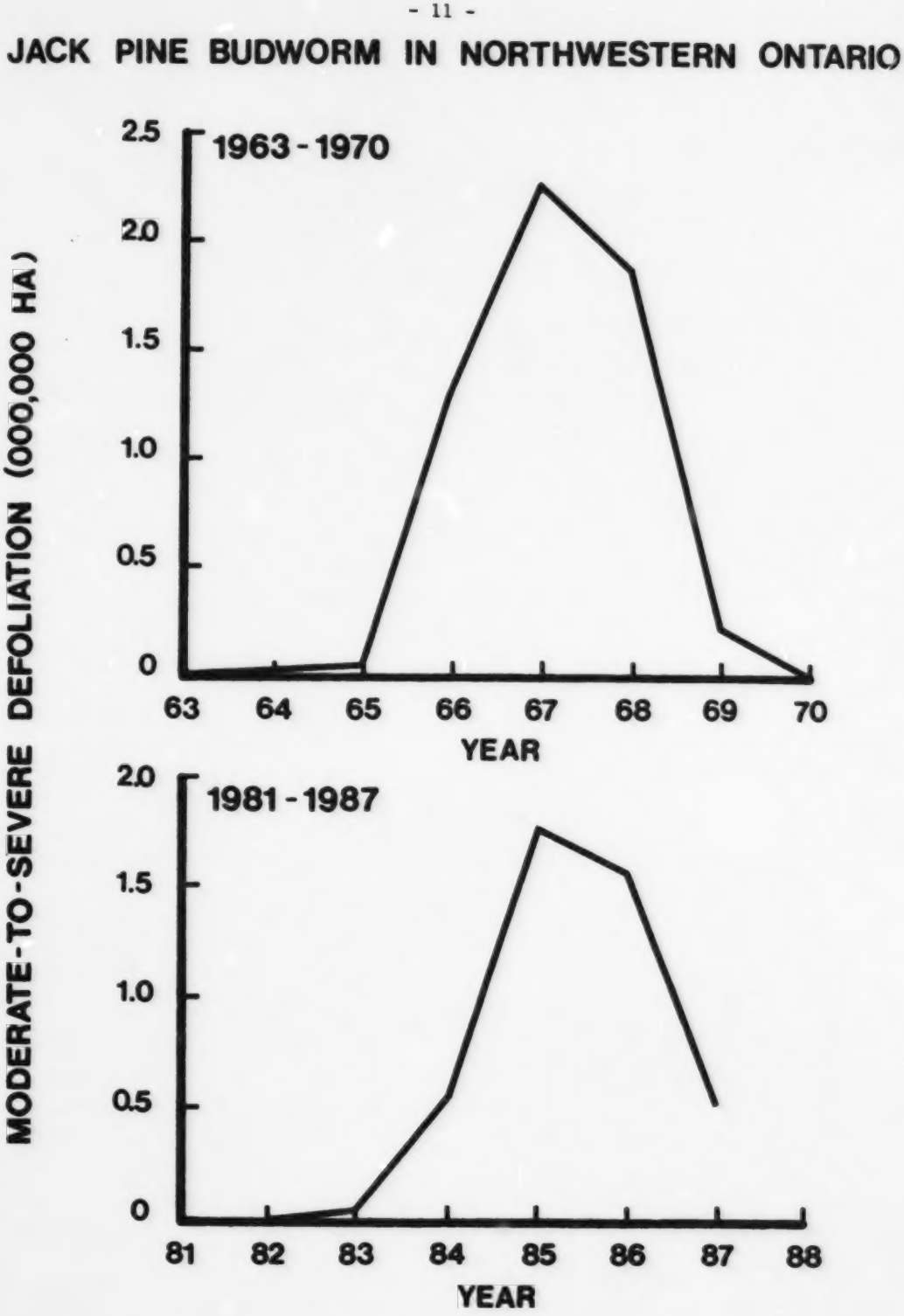


Figure 6. A comparison of two infestations of jack pine budworm in Northwestern Ontario, 1963-1970 and 1981-1987.

Region, resulted in five years of moderate-to-severe defoliation, then collapsed. The current jack pine budworm infestation which, in the early stage, included parts of the North Central Region, is in year five.

On the basis of the 1987 egg-mass survey results, population reductions are forecasted for 1988. In all, 199 locations were sampled and egg counts were high at 53 locations (27% of those sampled) (see Appendix, Table A2). The average number of egg masses at 97 locations (seven areas were sprayed with *B.t.* in 1987) common to 1986 and 1987 decreased by 73%. The modified infestation forecast is for light damage for all areas sampled in 1987. This adjusted forecast is based on increased parasitism and disease associated with an aging infestation as evidenced by a survey of second-instar larvae conducted in the Northwestern Region in October and November, 1986, which showed that 32% of the larvae recovered were parasitized.

On the basis of the history of the pest, the age of the current infestation and 1987 egg-mass counts, small pockets of light-to-moderate damage may persist in 1988 in some areas such as the Trout-Nungesser-Kirkness lakes area and the east-central portion of Dryden District.

A total of 105,463 ha of forested land was sprayed in Northwestern Ontario by OMNR to protect certain areas by limiting defoliation. Fixed-wing aircraft were used for a single application of Dipel 132 at a rate of 20 BIU/1.57 L/ha. The spray program began on 3 June and finished on 15 June. Overall results of the program indicated substantial foliage protection at all population densities.

Approximately 2,000 ha of whole-tree mortality and bare tops were mapped in Red Lake District in a narrow corridor that had experienced three years of moderate-to-severe defoliation from 1985 to 1987 (Fig. 7). The affected area occurred between the town of Red Lake in the south, Barrens Lake in the north, Nungesser Lake in the east and Kirkness Lake in the west. A mortality plot was established in a representative area of damage in a stand west of Pedlar Lake. The 100-tree assessment disclosed 11% bare tops and 4% recent whole-tree mortality.

NORTHWESTERN REGION

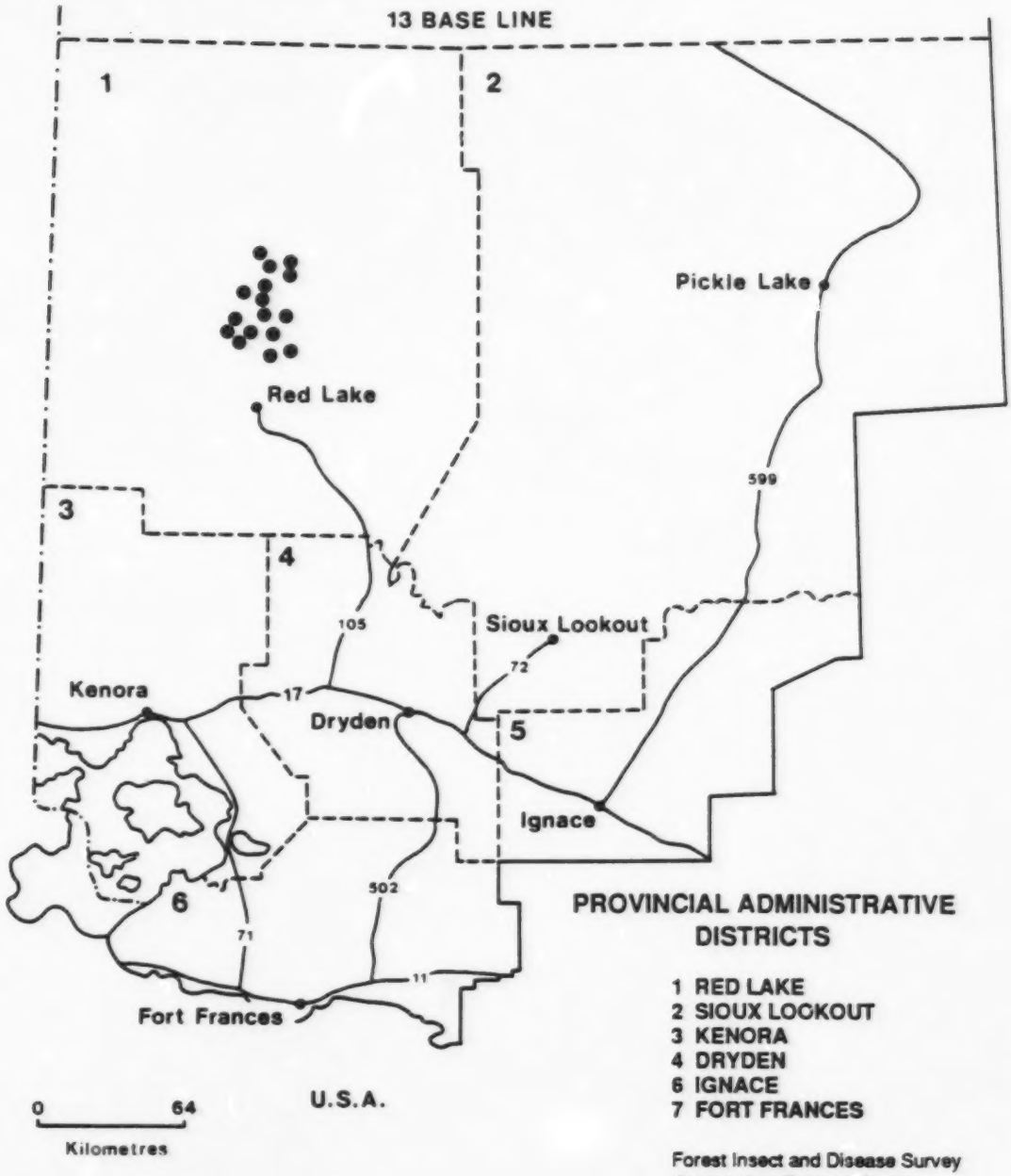


Figure 7. Jack Pine Budworm
(*Choristoneura pinus pinus* Free.)

Areas within which jack pine whole-tree mortality and top mortality occurred in 1987 .....●

Mortality plots established prior to 1987 were revisited. Increased whole-tree mortality was observed in all eight plots but the number of trees with bare tops decreased, an indication of some recovery in the absence of any defoliation (Table 4).

Table 4. Summary of jack pine budworm-associated tree mortality based on the examination of 100 jack pine trees at each location.

Location	Bare tops		Living		Dead	
	1986	1987	1986	1987	1986	1987
Kenora District						
Norway Lake	37	9	62	80	1	11
Red Lake District						
Artery Lake	3	0	96	89	1	11
Baird Twp	17	4	71	78	12	18
Bulging Lake	15	5	68	71	17	24
Caroll Lake	1	0	98	98	1	2
Haggart Lake	15	9	73	75	12	16
Pedlar Lake (west of)[a]	-	11	-	85	-	4
Royd Lake	27	3	71	91	2	6
Sabourin Lake	1	0	89	84	10	16

[a] established 1987

Greenstriped Mapleworm, *Dryocampa rubicunda* (F.)

Population increases were recorded in Fort Frances District in 1987. Comparable population levels have not been recorded in several years.

In the past this pest was recorded causing damage to red maple (*Acer rubrum* L.) in the Mine Centre area west of Halkirk and Watten townships and in the town of Fort Frances. Its greatest impact is in the damage caused to ornamentals of cottage and home owners (see photo page).

Low numbers of this pest were once again observed in Fort Frances District causing defoliation of understory and fringe red maple in Farrington, Halkirk and Watten townships as well as in the Reeves Lake area. Defoliation was as high as 70% on occasional trees but assessments of 5-m-tall trees at two locations disclosed that 50% of the trees had been attacked and that defoliation averaged 10%.

Forest Tent Caterpillar, *Malacosoma disstria* Hbn.

High populations of this pest were recorded in 1987, the first such occurrence since 1979 (see photo page).

The last infestation of forest tent caterpillar in the Northwestern Region lasted 21 years. Moderate-to-severe defoliation of trembling aspen (*Populus tremuloides* Michx.) was initially detected in 1959 on three islands in Eagle Lake, Dryden District. Each year thereafter until 1980, areas of moderate-to-severe damage were reported in the region. The previous infestation peaked in 1978 when medium-to-heavy infestations were recorded within 145,000 km^2 of forested land.

The current infestation consists of 32 small pockets of medium-to-heavy damage totaling 5,500 ha in the southern part of Fort Frances District (Fig. 8). Pockets of moderate-to-severe defoliation of trembling aspen were mapped near Mine Centre in the east, Chapple Township in the west, Claxton Township in the north and as far south as Hale Bay on Rainy Lake near the Canada-United States border. The largest area of moderate-to-severe defoliation, approximately 975 ha, was shared by Halkirk and Watten townships on Hwy 11. Except for a 2-ha area in Halkirk Township where complete defoliation was observed, defoliation in most other areas of moderate-to-severe damage averaged 80%.

Egg-band counts were conducted at 15 locations in the region in order to forecast populations in 1988. The recovery data are summarized in Table 5. High populations and subsequent moderate-to-severe defoliation are expected to recur within the same general area infested in 1987, with westward expansion to Lake of the Woods and eastward spread to the Atikokan-Fort Frances District border (Fig. 9). Successful hatch depends on several factors, however, such as temperature, foliar development and parasite levels.

Sawyer Beetles, *Monochamus* sp.

Surveys detected about 40 ha of recent whole-tree mortality of jack pine near logging operations at four locations. The affected trees were confined mainly to fringes of surviving stands or to small, poorly stocked stands growing on shallow sites.

The characteristic red flagging of damaged trees was observed in cutover areas in Bradshaw Township, Ignace District, Slaght and Barrett townships, Sioux Lookout District, and near Leitch Lake, Red Lake District.

Assessment at the Leitch Lake site disclosed that 80% of the branches on the 15-m-tall trees in a 5-ha stand of jack pine growing on a rocky site had been attacked.

NORTHWESTERN REGION

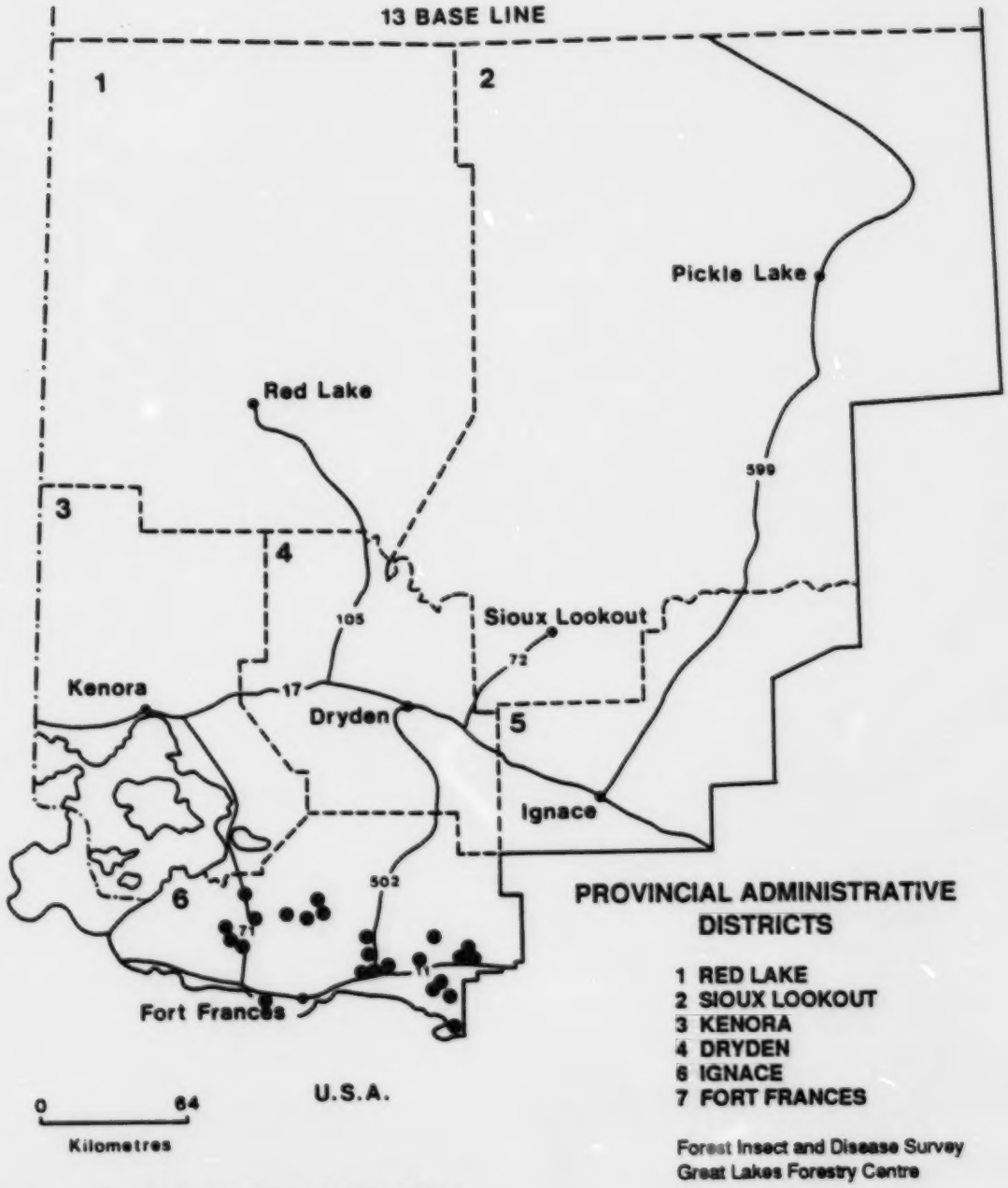


Figure 8. Forest Tent Caterpillar
(*Malacosoma disstria* Hbn.)

Areas within which moderate-to-severe defoliation occurred in 1987 ..... ●

NORTHWESTERN REGION

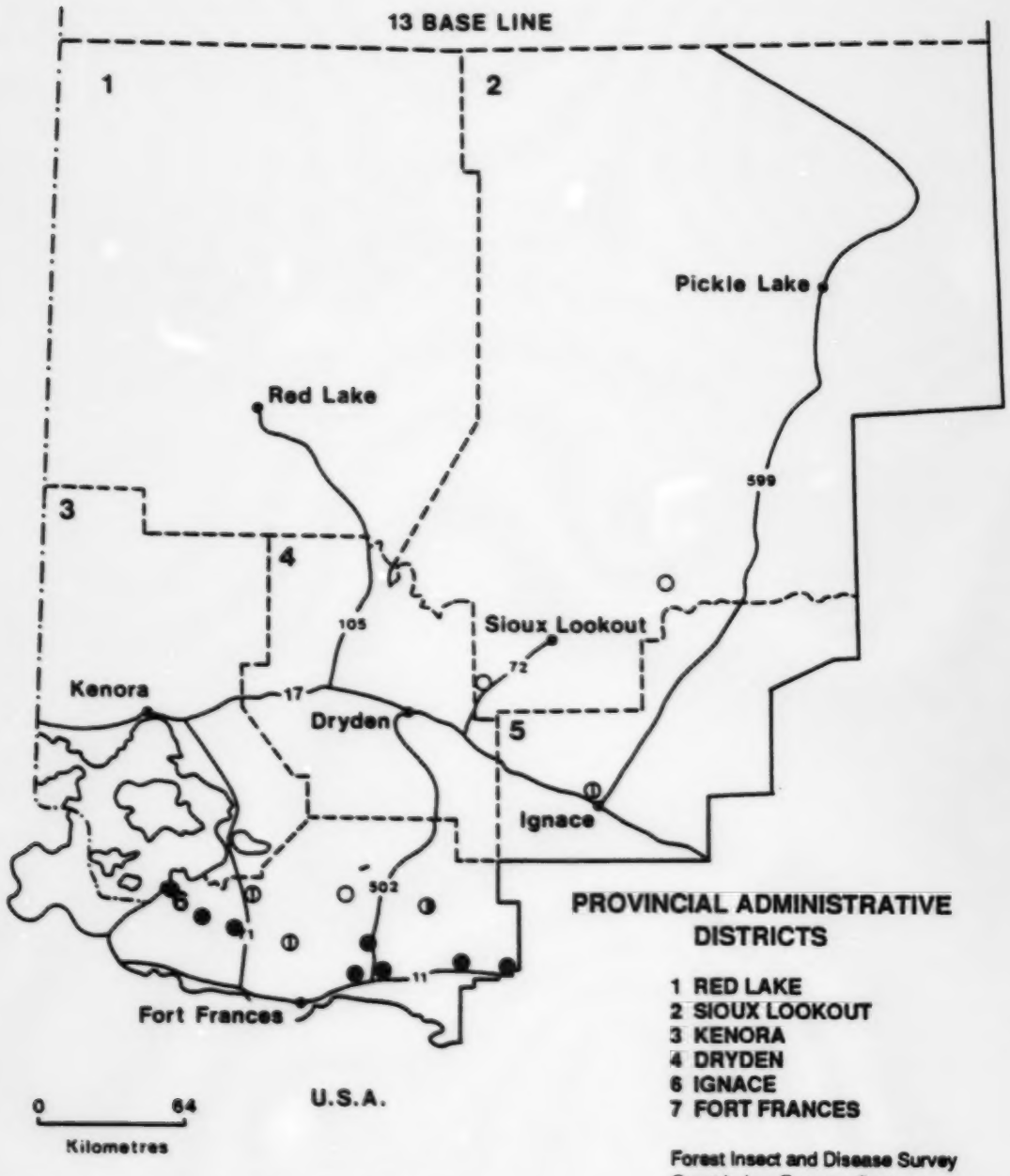


Figure 9. Forest Tent Caterpillar (*Malacosoma disstria* Hbn.)

Location of egg-band counts and defoliation forecasts for 1988

Severe ..... ● Light ..... ◑
Moderate .... ◕ Nil ..... ○

Table 5. Summary of forest tent caterpillar egg-band counts at 15 locations in the Northwestern Region in 1987 and infestation forecasts for 1988 (counts based on the examination of one to three trembling aspen at each location).

Location	Avg DBH of sample trees (cm)	No. of trees sampled	Total no. of egg bands	Infestation forecasts for 1988
Fort Frances District				
Claxton Twp	8.9	3	4	light
Crowrock Inlet-Hwy 502	10.9	1	21	severe
Dance Twp	10.0	3	4	light
Halkirk Twp	11.6	1	73	severe
McCrosson Twp	13.0	3	19	severe
Richardson Twp	8.7	1	18	severe
Seine River-Hwy 11	10.2	1	7	severe
Sifton Twp	9.5	3	27	severe
Turtle River Road	12.6	3	8	moderate
Turtle Station	13.7	1	12	severe
Watten Twp	8.7	1	9	severe
Weller Lake	8.7	3	0	nil
Ignace District				
Bradshaw Twp	12.5	3	1	light
Sioux Lookout District				
Echo Twp	11.0	3	0	nil
Hwy 516	12.3	3	0	nil

Balsam Fir Sawfly, *Neodiprion abietis* complex

Decreased populations were observed in 1987. A 14,000-ha area of light infestation was recorded in the Bruce-Pakwash lakes area, a slight northward shift in the 11,000-ha area of moderate-to-severe defoliation recorded in 1986. Fringe balsam fir trees of all age classes along Hwy 105, secondary roads, the gas pipeline, the powerline and the lakeshore were attacked. Little or no damage was detected on interior trees. Assessment of 11-m-tall balsam fir at one location within the infested area disclosed that 76% of the trees examined were affected; occasional trees experienced 75% defoliation, but overall foliar damage averaged 10%. A survey of 2.5-m-tall balsam fir at another location revealed that 17% of the trees were attacked and defoliation averaged 10%.

Light defoliation was observed in stands in Kenora District from Sioux Narrows north along Hwy 71 to Kenora and along Hwy 596 south to Kenora. Assessment at this latter location showed that 18% of the trees had been attacked and defoliation averaged 10%.

Pine Sawflies: Pine Sawfly, *Neodiprion maurus* Roh., Red Pine Sawfly, *N. nanulus nanulus* Schedl, Jack Pine Sawfly, *N. pratti banksianae* Roh., Jack Pine Sawfly, *N. pratti paradoxicus* Ross, Swaine Jack Pine Sawfly, *N. swainei* Midd., Red-headed Jack Pine Sawfly, *N. virginianus* complex

Populations of these sawflies of jack pine and red pine (*Pinus resinosa* Ait.) were widespread across the Northwestern Region, however, associated damage was light.

In 1987, *Neodiprion maurus* caused 5% defoliation of jack pine regeneration in Hodgson Township, Ignace District and along Hwy 11 at the Seine River, Fort Frances District. An assessment of 2.1-m-high fringe trees at the Hodgson Township location showed that 3% of the trees supported an average of one colony per tree.

Current levels of defoliation caused by *N. nanulus nanulus* remained comparable to those of 1986. An evaluation of 100 red pine and jack pine trees, averaging 5 m in height, disclosed 5% defoliation on one tree in Wabigoon Township, Dryden District. This assessment typified results obtained from areas infested in Dewan Township, Ignace District and LeMay Township, Kenora District.

Single colonies of *N. pratti banksianae* were observed in Caliper Lake Provincial Park, Claxton Townsnip, Fort Frances District, causing 50% defoliation on several understory jack pine. *Neodiprion pratti paradoxicus* was recorded causing light damage to fringe jack pine in the Vermeersch Black Spruce Seedling Seed Orchard, Ignace District.

Single colonies of the potentially destructive *N. swainei* were collected in Fort Frances District in a 100-ha plantation of jack pine in Croome Township and on small islands in Swell Bay, Rainy Lake.

Neodiprion virginianus was recovered from two areas in the region this year. Assessments of open-growing 2-m-tall jack pine near Godson Lake, Dryden District, and in Furniss Township, Ignace District, revealed an average incidence of 1% with associated defoliation of 80%.

Aspen Leafblotch Miner, *Phyllonorycter ontario* (Free.)

Decreased populations of this pest were encountered across the region in 1987 although areas of moderate-to-severe foliar damage persisted. High populations were found attacking open-growing or forest edge and roadside trees under 4.0 m in height.

The highest populations were encountered along a 1-km portion of the Nungesser Road in Red Lake District where 100% of the foliage of 3-m-tall trees had been attacked and there was an average of seven mines per leaf. Elsewhere in the region, damage was typically sporadic and not as widespread as in previous years. Overall foliar damage at the locations sampled ranged from 5% to 100% but averaged 63% and the accompanying number of mines per leaf averaged 2.8 (Table 6).

Table 6. Summary of aspen leafblotch miner counts on trembling aspen at 14 locations in the the Northwestern Region in 1987.

Location	Avg height of trees (m)	Foliage affected (%)	Avg no. of mines per leaf
Dryden District			
Zealand Twp	3.0	100	3
Fort Frances District			
Big Sawbill Lake	2.5	100	5
Cuttle lake	4.0	100	2
Farrington Twp	3.0	100	3
Glenorchy Road	2.8	80	2
McCrosson Twp	5.0	86	3
Ignace District			
Crystal Cr. Hwy 599	3.0	17	2
Red Lake District			
Bateman Twp	3.0	100	7
Longlegged Lk area	2.0	5	1
Hwy 105 Red Lk	2.0	7	1
Snake Falls Rd	2.0	72	2
Wenasage Lk Rd	3.0	11	1
Sioux Lookout District			
Dominion Lk Rd	3.0	8	2
Vermilion River Rd	3.0	100	5

White Pine Weevil, *Pissodes strobi* (Peck)

Populations of this pest continued to increase in the region in 1987; in fact, results from the current survey represent the highest damage levels reported in the region in the past 10 years.

In all, 14 areas of jack pine regeneration were evaluated in 1987, 11 of which were also examined in 1986. Except for a negative survey in a 500-ha area in MacNicol Township, Kenora District, average leader damage ranged from 0.7% to as high as 20%, recorded in a 30-ha plantation of 1.9-m-tall trees on the Dixie Lake Road, Red Lake District (Table 7). The increased populations were reflected in a higher incidence of leader attack observed in six of the 11 areas assessed in both years and leader damage at the 11 common locations averaged 9.9% in 1987 in comparison with 6.8% in 1986.

Table 7. Summary of damage caused by the white pine weevil at 13 locations in the Northwestern Region in 1987 (counts based on the examination of 150 randomly selected jack pine trees at each location).

Location	Avg ht of trees (m)	Estimated trees per ha	Estimated area affected (ha)	Leaders attacked (%) 1986	1987
Dryden District					
Snake Bay Road km 37	2.3	3200	10	15.3	16.0
Snake Bay Road km 42	2.8	4000	100	2.0	0.7
Fort Frances District					
Big Sawbill Lake	3.0	8000	40	17.3	18.7
Manion Lake	1.0	1000	5	12.0	13.3
Turtle River Road	2.5	3200	250	7.3	18.0
Ignace District					
Furniss Twp	1.2	7000	50	8.7	8.7
Six Mile Lake Road	1.7	4166	100	-	2.7
Kenora District					
MacNicol Twp	1.2	8500	500	0.0	0.0
McMeekin Twp	2.7	2990	25	2.7	2.0
Red Lake District					
Dixie Lake Road	1.9	2600	30	2.7	20.0
McKenzie Bay Road	2.4	2800	100	5.3	10.0
Sioux Lookout District					
Dominion Lake Road	2.2	8300	100	2.0	1.3
Goodie Lake	1.2	3800	25	-	0.7

Mountain-ash Sawfly, *Pristiphora geniculata* (Htg.)

Damage by this pest on American mountain-ash (*Sorbus americana* Marsh.) was first recorded in the Northwestern Region in the town of Fort Frances in 1981 and since then the insect has steadily increased its range.

The highest numbers in 1987 were recorded along a 20-km section of Hwy 105, north of Ear Falls, Red Lake District where a 50-tree assessment at one location disclosed that the entire sample had been attacked and defoliation averaged 70%.

Somewhat lower populations were observed in Dryden and Ignace districts. Two 50-tree evaluations of 2.0-m-tall trees disclosed a 62% incidence of attack with accompanying defoliation of 35%, and a 48% incidence of attack with 20% average defoliation in Dryden and Ignace districts, respectively. On average, 10% of the trees were attacked at one location in each of the districts of Fort Frances, Kenora and Sioux Lookout, and defoliation amounted to 20%.

Minor Insects

Northern Pitch Twig Moth, *Petrova albicapitana* (Bsk.)

This pest requires two years to complete its life cycle, overwintering in the larval stage and pupating within a pitch nodule (mass of pitch). Larvae feed singly within the nodule of pitch, usually at an internode or fork in the wood. The feeding damage extends almost to the pith.

When the base of a growing terminal is attacked, it may be girdled and die. Main-stem feeding results in growth reduction and predisposes the tree to wind breakage. The feeding sites also provide entrance courts for disease.

Four areas in the region were examined in 1987 to determine the impact of this pest on young jack pine (Table 8). The incidence of main-stem attack ranged from 0.7% to 2.0%.

Low populations were observed at widely separated locations elsewhere in the region.

Table 8. Summary of damage caused by the northern pitch twig moth at four locations in the Northwestern Region in 1987 (counts based on the examination of 150 randomly selected jack pine regeneration trees at each location).

Location (Twp)	Estimated area infested (ha)	Estimated trees per ha	Avg ht of trees (m)	Main stem attacked (%)
Ignace District				
Furniss	50	7000	1.2	0.7
Red Lake District				
Coli Lake	25	2300	0.8	2.0
Dixie Lake Rd	30	2600	1.9	1.3
Sioux Lookout District				
Goodie Lake	25	3800	1.2	1.3

Table 9. Other forest insects.

Insect	Host(s)	Remarks
Acleris variana (Fern.) Eastern blackheaded budworm	wS	0.7% of 6.1-m-tall trees with < 1% defoliation in a 3-ha plantation in Byshe Twp, Red Lake District
Altica sp. probably *carinata* Flea beetle	E	Moderate populations caused 70% defoliation on 18% of the 13.6-m-tall trees in McIrvine Twp, Fort Frances District.
Aphrophora cribrata (Wlk) Pine spittlebug	jP, bS	Assessment in three plantations in which trees averaged 1.1 m in height in each of the Fort Frances, Red Lake and Sioux Lookout districts disclosed that 6.1% of the trees had been attacked, and had an average of two spittle masses per tree.
Archips cerasivoranus (Fitch) Uglynest caterpillar	Ch	high populations observed at one location near Snake Falls, Red Lake District
Cephalcia spp. Webspinning sawfly	rP	A 50-tree examination near Edward Lake, Dryden District, disclosed that 8% of the 3.7-m-tall trees in a 2-ha area were infested, and had an average of 10% defoliation. Low populations were observed in Smellie Twp, Dryden District, and near Mine Centre, Fort Frances District.
Conophthorus banksianae McP.	jP	Assessment disclosed 4% lateral damage in a 25-ha area of 1.2-m-tall trees near Goodie Lake, Sioux Lookout District. Low populations were also recorded along the Dixie Lake Road, Red Lake District and near Godson, Dryden District.

(cont'd

Table 9. Other forest insects (cont'd)

Insect	Host(s)	Remarks
Croesus latitarsus Nort. Dusky birch sawfly	wB	low numbers recovered from 2-m-tall trees near Ear Falls, Red Lake District
Datana ministra (Dru.) Yellownecked caterpillar	crab-apple	5% defoliation recorded on a single ornamental tree in the town of Fort Frances, Fort Frances District
Eriocampa ovata (L.) Woolly alder sawfly	Al	All (100%) fringe trees averaging 2.7 m in height sustained 80% defoliation for 3 km along the Henderson Loop Rd, Britton Twp, Dryden District.
Eucosma gloriola Heinr. Eastern pine shoot borer	jP	Examination of 1.2-m-tall trees in Furniss Twp, Ignace District and Goodie Lake, Sioux Lookout District, disclosed that 2% of the trees were damaged and 1.3% and 0.7% of the leaders were attacked, respectively.
Gilpinia hercyniae (Htg.) European spruce sawfly	wS	low populations recorded affecting 0.7% of the 5-m trees in a 5-ha plantation near Tramp Bay, Lac Seul, Sioux Lookout District
Lochmaeus bilineata Pack. Elm prominent	E	In McIrvine Twp, Fort Frances District, 17.3% of the 13.6-m-tall roadside trees sustained 5% defoliation, and had an average of three colonies per tree.
Malacosoma californicum pluviale (Dyar)	Ch, wB	High populations caused 100% defoliation on 86% of the trees near Tower Lake, Kenora District. Low numbers were recorded along Hwy 599, along the Pelican Falls road and in the Wrenkos Landing area in Ignace, Sioux Lookout and Fort Frances districts, respectively.

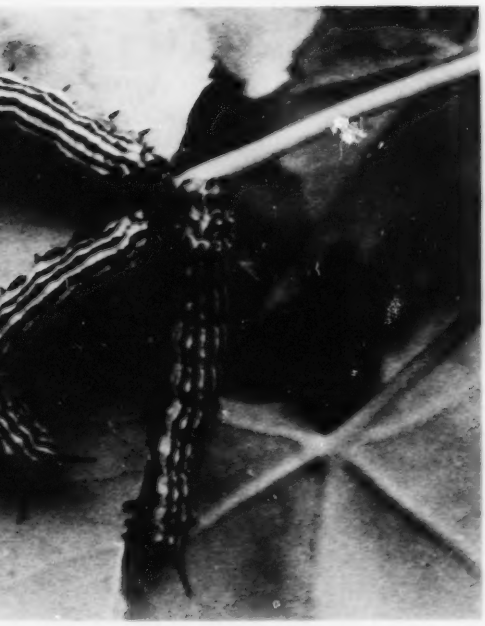
(cont'd)

Table 9. Other forest insects. (concl.)

Insect	Host(s)	Remarks
Nematus salicisodoratus Dyar Willow sawfly	wB	one colony recovered from a 2-m tree north of Ear Falls, Red Lake District
Nymphalis antiopa (L.) Spiny elm caterpillar	W	In a 1.5-ha area in Kingsford Twp, Fort Frances District, 10% of 4-m trees experienced 15% defoliation and similar defoliation was observed in the town of Fort Frances.
Pikonema alaskensis (Roh.) Yellowheaded spruce sawfly	wS	Except for low numbers found on ornamentals in the town of Fort Frances this pest was not observed.
Pineus similis (Gill.)	wS	low numbers of galls recorded on 0.7% of the 2-m-tall trees in a 1-ha plantation along the Deer Lake Rd, Dryden District; low numbers also found near Rough Rock Lake, Kenora District and in Lake of the Woods Provincial Park, Fort Frances District
Pissodes approximatus Hopk. Northern pine weevil	bS	light damage detected on 1.2-m-tall trees in Ferguson Black Spruce Seedling Seed Orchard, Furniss Twp, Ignace District
Pseudexentera oregonana Wlshm. Early aspen leafcurler	tA	At Longbow Lake in Kirkup Twp, Kenora District, 15-m trees sustained 25% foliar damage and 5% defoliation was observed at widely scattered locations throughout the region

Mature larvae of the
(*Dryocampa rubicunda*
(*Acer rubrum* L.) foli

Migrating larvae of the forest tent caterpillar (*Malacosoma disstria* Hbn.) on the trunk of a trembling aspen (*Populus tremuloides* Michx.)



the greenstriped mapleworm
nda [F.]) feeding on red maple
foliage

Foliar discoloration of trembling aspen (*Populus tremuloides* Michx.) caused by cold temperatures

Main stem infection on a young jack pine (*Pinus banksiana* Lamb.) caused by the western gall rust (*Endocronartium harknessii* [J.P. Moore] Y. Hirats.)

TREE DISEASES

Major Diseases

Armillaria Root Rot, *Armillaria mellea* (Vahl:Fr.) Kummer

Evaluations were conducted at 34 locations and included three tree species: black spruce, white spruce and jack pine. Root rot surveys carried out in the 11 black spruce seedling orchards and 12 white spruce plantations are discussed under SPECIAL SURVEYS.

Eleven areas of jack pine regeneration with trees < 3 m in height were assessed. In three (27%) of the areas examined an average of 1% of the trees had been attacked. As well, mortality was observed outside of the sample plots at four locations (Table 10). The highest incidence of attack occurred in a 100-ha area of 2.2-m-tall jack pine in Block 9, Sioux Lookout District, where 2% mortality was recorded.

The results of the 1987 survey of jack pine are typical of those for the 12-year period 1975-1986, during which yearly averages of trees affected ranged from .7% to 2.2%.

Table 10. Summary of damage caused by Armillaria root rot at 11 locations in the Northwestern Region in 1987 (counts based on the examination of 150 randomly selected jack pine trees at each location).

Location	Avg ht of trees (m)	Estimated trees per ha	Estimated area affected (ha)	Current mortality (%)
Dryden District				
Mafeking Twp	2.3	7000	20	0[a]
Rawlinson Lake	2.7	7000	100	0
Fort Frances District				
Otter Rapids	1.4	4500	150	0
Turtle River Rd	2.5	8000	50	0[a]
Ignace District				
Furniss Twp	1.2	7000	50	0[a]
Kenora District				
Coyle Twp	1.4	12000	200	0
McMeekin Twp	2.1	2800	25	0
Red Lake District				
Coli Lake	0.8	2300	25	0[a]
Gullrock Lake	1.5	1850	100	.7
Sioux Lookout				
Block 9	2.2	8300	100	2.0
Goodie Lake	1.2	3800	25	.7

[a] observed near sample plots

Dutch Elm Disease, *Ceratocystis ulmi* (Buism.) C. Moreau

The disease was first detected in the region in 1977 in the town of Fort Frances and since then a rapid increase in incidence and in resulting tree mortality of white elm (*Ulmus americana* L.) has been observed, especially in the western part of Fort Frances District.

A rural survey in Crozier Township and urban assessments in the towns of Rainy River and Fort Frances disclosed infection of 12.7%, 50.5% and 19.3%, respectively, on the trees examined (Table 11). Tree mortality ranged from 4.0% to 19.2% at the three locations. The incidence of attack in the town of Rainy River was a substantial increase over the 11% revealed in a previous survey in 1982.

Table 11. Summary of infection caused by Dutch elm disease at three locations in the Northwestern Region in 1987 (counts based on the examination of 150 trees at each location).

Location	Avg ht of trees (m)	Avg DBH of trees (cm)	Trees affected (%)	Trees severely affected[a] (%)	Trees dead (%)
Fort Frances District					
Crozier Twp	13.6	25.1	12.7	7.3	4.0
Fort Frances	21.2	44.4	19.3	14.7	11.3
Rainy River	11.6	30.2	50.5	36.4	19.2
Average	15.5	33.2	27.5	19.5	11.5

[a] trees with more than 25% of the crown affected but still living

Western Gall Rust, *Endocronartium harknessii* (J.P. Moore) Y. Hirats.

This rust, when occurring on the main stem, is capable of killing small-diameter trees or causing trees to break at the point of infection; branch infections or galls often result in death to that part of the branch distal to the gall. In either case, however, active galls continue to increase in size and produce spores annually (see photo page).

Quantitative surveys in 12 areas of jack pine regeneration with trees >3 m in height revealed an increased incidence of damage in 1987 (Fig. 10). The results of the 1987 survey represent the highest levels of infection recorded in the region in the last eight-year period. From 4.7% to 36% of the trees were affected. The incidence of trees attacked averaged 21.6% in the current assessment, up considerably from the 5% recorded in eight areas examined in 1986. The number of mainstem infections increased significantly in 1987: 11.6% of the trees examined

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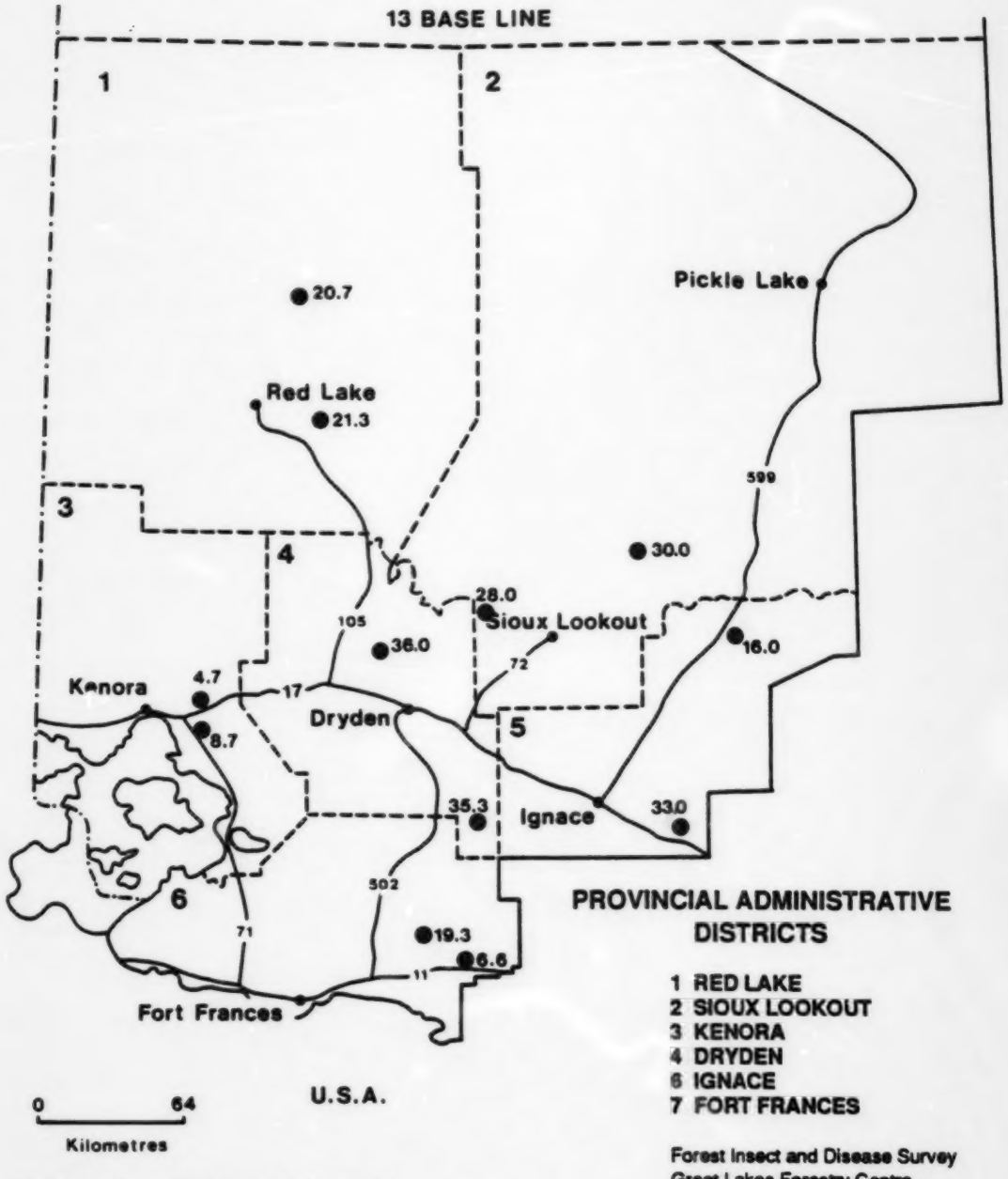

Figure 10. Western Gall Rust
(*Endocronartium harknessii* [J.P. Moor.] Y. Hirats.)

Locations of plantations sampled and percentage of trees affected .....●

had main-stem infections, whereas in 1986 this figure was only 1.6%. Current whole-tree mortality was detected at three locations in the survey plots and in one other area outside of the survey plots (Table 12).

Shoot Blight, *Sirococcus conigenus* (DC.) P. Cannon & Minter

The fungus attacks red pine of all sizes and understory red pine are often severely infected by means of spores discharged in spring from older overstory trees. The current year's shoot is infected, and consequently the needles droop. Damage is cumulative and repeated attacks on younger trees can result in whole-tree mortality.

Trees exhibiting symptoms of shoot blight have been observed in the region since 1970 but it was not until 1973 that the pathogenic agent was positively identified. At that time, the disease was collected at several locations including one in Echo Township, Sioux Lookout District, and another near Blue Lake, Dryden District.

These two areas were revisited in 1987. A survey of 150 understory red pine, 0.5 to 4.0 m in height, was conducted near Kathlyn Lake in Echo Township, Sioux Lookout District, and at Blue Lake Provincial Park in Smellie Twp, Dryden District, and the incidence of trees infected averaged 45% and 36%, respectively. Three percent tree mortality was recorded at the location in Echo Township.

Minor Diseases

Spruce Needle Rusts, *Chrysomyxa ledi* (Alb. and Schwein.) de Bary var. *ledi* and *C. ledicola* (Peck) Lagerh.

Foliar damage to white spruce and black spruce in 1987 was less than that noted in the previous two years. (In 1985 255,000 ha of spruce experienced moderate-to-severe foliar infections in Red Lake District.

Except for a 5-ha area of 2-m-tall natural black spruce near Sidace Lake, Red Lake District, where the entire sample was affected and foliar damage averaged 50%, no widespread areas of moderate-to-severe infections were observed. Examination of a stand of 10-m-tall black spruce near the area of damage at Sidace Lake disclosed that the entire stand was affected, but foliar damage averaged only 1%. This trend of high incidence but accompanying light foliar damage typified the regional situation for black spruce.

The situation with respect to white spruce was similar, as was evidenced in the white spruce plantation survey. Evaluations were conducted in 12 plantations but the needle rust was found at only five locations, and although the incidence of the disease was as high as 100%, average foliar damage never exceeded 1%.

Table 12. Summary of damage caused by western gall rust on jack pine at 12 locations in the Northwestern Region in 1987 (counts based on the examination of 150 randomly selected trees at each location).

Location	Avg ht of trees (m)	Estimated trees per ha	Estimated area affected (ha)	Trees affected (%)	Trees severely affected[a] (%)	Current mortality (%)
Dryden District						
Mafeking Twp	2.3	7000	20	36.0	20.0	0
Rawlinson Lake Rd	2.7	7000	100	35.3	7.3	0
Fort Frances District						
Otter Falls	1.4	4500	150	19.3	11.3	.7
Turtle Station	2.5	8000	50	6.6	4.0	0
Ignace District						
Furniss Twp	1.2	7000	50	33.0	21.0	0
Six Mile Lake	1.7	4100	100	16.0	3.3	
Kenora District						
Coyle Twp	1.4	12000	200	4.7	4.7	0
McMeekin Twp	2.1	2800	25	8.7	5.3	0
Red Lake District						
Colt Lake	0.8	2300	25	20.7	20.7	0
Gullrock Lake	1.5	1850	100	21.3	4.0	.7
Sioux Lookout District						
Goodie Lake	1.2	380	25	28.0	20.7	1.3
Stanzhikimi Lake Rd	1.1	5000	20	30.0	17.3	0[b]

[a] stem galls
[b] mortality observed off plots

Pine Needle Rust, *Coleosporium asterum* (Dietel) Sydow

This needle rust is a common problem in jack pine regeneration. The older foliage is infected and repeated moderate-to-severe foliar damage results in growth reduction. An alternate host, either aster (*Aster* spp.) or goldenrod (*Solidago* spp.), is required for *C. asterum* to complete its life cycle.

In the current year, several areas of jack pine regeneration under 3 m in height were examined and only light damage was found. Seven locations in which jack pine and the alternate hosts were growing in close proximity typified the regional situation. The incidence of trees attacked ranged from 3.3% to 100% and foliar damage averaged 1.6% (Table 13).

Table 13. Summary of damage caused by pine needle rust on jack pine at seven locations in the Northwestern Region in 1987 (counts based on the examination of 150 trees at each location).

Location	Avg ht of trees (m)	Estimated trees per ha	Estimated area affected (ha)	Trees affected (%)	Foliar damage (%)
Dryden District					
Mafeking Twp	2.3	7000	20	100	1.0
Rawlinson Lake	2.7	7000	100	43	1.0
Fort Frances District					
Otter Falls	1.4	4500	150	100	5.0
Turtle Station	2.5	8000	50	100	1.0
Kenora District					
Coyle Twp	1.4	12000	200	3.3	1.0
McMeekin Twp	2.1	2800	25	72.7	1.0
Red Lake District					
Gullrock Lake	1.5	1850	100	5	1.0

Sweetfern Blister Rust, *Cronartium comptoniae* Arthur

This stem rust requires the presence of an alternate host, either sweetfern (*Comptonia peregina* [L.] Coult.) or sweet gale (*Myrica gale* L.), to complete its life cycle. The rust is capable of killing small-diameter jack pine and causing basal stem defect in trees of merchantable size.

The disease was positively identified at two locations and a rust, probably *C. comptoniae,* was recovered from another. The highest incidence of the disease was recorded in a 50-ha area of 2.5-m-tall trees near Turtle Station, Fort Frances District, where 14.6% of the trees examined were infected. In Coyle Township, Kenora District, in the other area in which positive identification was made, the incidence of basal stem cankers on 1.4-m-tall trees averaged 1.3%.

Tar Spot Needle Cast, *Davisomycella ampla* (J. Davis) Darker

The impact of this needle cast is usually minimal except when young trees are subjected to repeated moderate-to-severe infections, which can result in growth loss.

Several areas of jack pine regeneration under 3 m tall were examined to determine if this disease was present and at what levels. Light-to-moderate (5%-75%) defoliation was recorded in only two areas. Assessment in a 25-ha area of 2.1-m-tall jack pine near Goodie Lake, Sioux Lookout District, disclosed that 21% of the trees were affected and foliar damage averaged 20%. Another survey in a 50-ha area of 1.2-m-tall trees in Furniss Township, Ignace District, revealed that 20% of the trees examined were affected and accompanying foliar damage was 12%.

Balsam Poplar Leaf Diseases, *Linospora tetraspora* G.E. Thompson,
Mycosphaerella populorum G.E. Thompson

The entire forest component of balsam poplar *(Populus balsamifera* L.) was severely affected by one or both of the following foliage diseases: linospora leaf blight *(Linospora tetraspora)* and septoria canker *(Mycosphaerella populorum)*. Host trees of all size classes were affected and trees in most stands experienced moderate-to-severe (25%-100%) leaf-browning and premature defoliation.

Table 14. Other forest diseases.

Disease	Host(s)	Remarks
Aureobasidium apocryptum (Ell. & Ev.) Hermanides-Nijhof	wB, rM	pockets of 100% incidence accompanying foliar damage of 92% observed in the Crowrock Inlet area of Fort Frances District
Cronartium commandrae Peck Comandra blister rust	jP	Branch infections averaged 3.5% on trees <3 m in height at four locations in the southern part of the region.
Gymnosporangium clavariiforme (Pers.) DC.	Common juniper	branch mortality recorded near Bass Lake, Godson Twp, Kenora District
Gymnosporangium cornutum Arthur ex Kern Gall rust	aMo	100% foliar damage observed on 2.4-m-tall trees at widely separated locations in Dryden and Kenora districts
Phyllosticta spp. Leaf spot	gAs	severe foliar infections recorded on ornamental trees in the Dryden Forest Station in Zealand Twp, Dryden District
Venturia macularis (Fr.) E. Müller & v. Arx Shoot blight	tA	Assessment in the Pike Lake area, Ignace District, disclosed that 26% of the 1.4-m-tall trees were attacked and that terminal shoot mortality averaged 17%.

ABIOTIC DAMAGE

Frost

Low temperatures and accompanying late spring frosts occurred from 21 to 23 May when temperatures as low as -2.3°C were recorded in the region (Table 15). This cold spell resulted in foliar damage to both deciduous and coniferous trees, the severity of damage depending on leaf or shoot development at the time of the frost. The four tree species most adversely affected by the cold spell were trembling aspen, white spruce, black spruce and balsam fir. White birch (*Betula papyrifera* Marsh.) and tamarack (*Larix laricina* [Du Roi] K. Koch) were also affected in a few areas but to a lesser degree. Except for a small area of overlap in Dryden and Sioux Lookout districts, the area of frost-damaged conifers was separate from that of the frost-damaged trembling aspen (Fig. 11).

NORTHWESTERN REGION

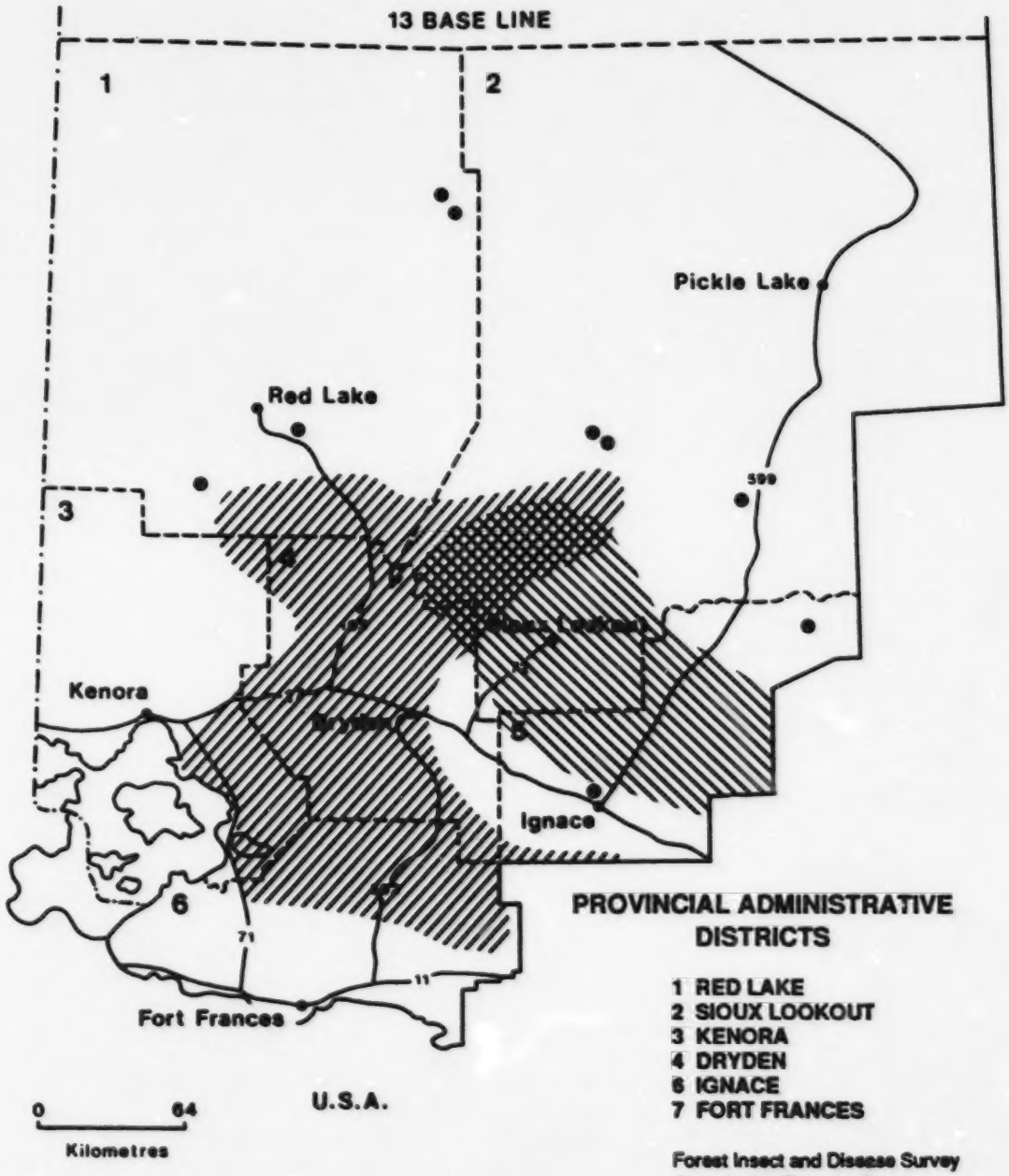

Figure 11. Frost

Area within which damage occurred in 1987. deciduous ..... or ●

coniferous .....

Light-to-moderate (5%-75%) foliar damage to trembling aspen was widespread and sporadic, a reflection of leaf development at the time of exposure to the cold (see photo page). The area within which pockets of damage were commonly observed was in the southern part of the region and included the northern part of Fort Frances District, the eastern portion of Kenora District, most of Dryden District, the southeastern corner of Red Lake District, the southwestern corner of Sioux Lookout District and only a very small area in the southwestern half of Ignace District. Scattered pockets of damaged aspen were also mapped outside this area as far north as the 11th baseline. Areas of discolored aspen were usually less than 10 ha in size although in the Lac Seul area in Sioux Lookout District, where the heaviest concentration of damage was observed, several pockets, each as large as 100 ha, had discolored trees. Assessment in three typical areas of frost-damaged aspen averaging 13 m in height, one in each of Fort Frances, Dryden and Sioux Lookout districts, disclosed that foliar damage ranged from 33% to 69%.

Table 15. Minimum daily temperatures for a five-day period in May at five locations in the Northwestern Region in 1987.

Location	Minimum daily temperatures for May, 1987				
	20	21	22	23	24
Cochenour Airport	6.2	-2.3	-0.9	6.2	3.4
Dryden Airport	8.4	-0.8	-1.3	0.8	5.6
Fort Frances Airport	9.5	3.5	0.5	-1.5	3.0
Kenora Airport	9.0	-0.2	-0.5	4.1	7.4
Sioux Lookout Airport	8.0	-1.2	-1.9	0.9	5.1

Frost damage to balsam fir, white spruce and black spruce was confined to the southeastern part of the region, with the largest area observed in the districts of Ignace and Sioux Lookout and a small area in the northeast corner of Dryden District. The area of frost damage to conifers in the Northwestern Region was part of a much larger continuous area of moderate-to-severe damage that encompassed parts of Thunder Bay, Nipigon and Terrace Bay districts of the North Central Region and Hearst and Kapuskasing districts of the Northern Region.

White spruce and balsam fir in all height classes were affected but damage to black spruce was confined to open-growing trees <5 m in height, especially those in low-lying areas. Foliar damage was variable within the area of frost damage indicated on the map, with shoot damage varying from light (<25%) to moderate-to-severe (26%-100%). Ground checks disclosed balsam fir shoot mortality as high as 52% on 10-m-tall trees in Drayton Township, Sioux Lookout District (Table 16). Shoot mortality averaged 81% in the Dawe white spruce clonal orchard in Ignace District and assessment in two white spruce plantations, one a 100-ha area of 3.0-m-tall trees near Shrimp Lake, Ignace District, the other a 5-ha plantation of 5.0-m-tall trees near Tramp Bay on Lac Seul, Sioux

Table 16. Summary of damage caused by frost at 37 locations in the Northwestern Region in 1987.

Location	Host[a]	Avg ht of trees (m)	Estimated trees per ha	Trees affected (%)	Foliar damage (%)
Dryden District					
Britton Twp	wS	2.5	5000	100	16
Hwy 502	tA	10.0	4000	100	33
Melgund Twp	bS	1.2	3200	97	6
Rugby Twp	wS	1.3	1200	100	2
Fort Frances District					
Bad Vermilion Lake	bF	15.0	-	100	5
Kingsford Twp	wS	4.4	1500	50	1
Kawawia Creek	bS	0.7	2990	62	1
Manion Lake	bS	1.2	3200	99	4
Morson Twp	bS	1.1	3200	69	1
Oliver Creek	tA	16.0	1000	100	69
Ignace District					
Bark Lake	bS	1.1	3200	72	19
Bertrand Twp	bF	15.0	-	100	30
Cobb Lake	bF	12.0	4500	100	37
Paguchi Lake	wS	.7	-	100	81
Raleigh Lake		15.0	-	100	15
Sandbar Lake	bF	10.0	3100	100	23
Shrimp Lake	wS	3.0	1800	100	51
Kenora District					
Minnisabic Lake	bS	1.3	3200	71	1
Ulster Lake	bS	1.2	3200	25	1
Red Lake District					
Beauregard Lake	bS	1.0	3200	28	1
Byshe Twp	tA	2.0	-	100	5
Centennial Plantation	wS	6.1	3000	100	10
Nungesser Rd km 45	wB	4.0	-	100	15
Snake Falls	wS	1.1	3900	100	10

(cont'd)

Table 16. Summary of damage caused by frost at 37 locations in the Northwestern Region in 1987 (concl.).

Location	Host[a]	Avg ht of trees (m)	Estimated trees per ha	Trees affected (%)	Foliar damage (%)
Sioux Lookout District					
Deception Bay	bF	9.7	3300	100	37
Drayton Twp	tA	10.0	-	100	60
Drayton Twp	bF	15.0	-	100	52
Goodie Lake North	bS	1.1	3200	87	17
Goodie Lake South	bS	1.3	3200	87	17
Jordan Twp	bF	12.0	-	100	30
Lac Seul-Merritt Bay	bF	12.0	-	100	33
-Tramp Bay	wS	5.0	120	100	44
-Whitefish Bay	bF	15.0	-	100	27
Pacific Lake	bF	10.0	2500	100	45
Savant Lake	bF	10.0	-	100	25
Skurban Lake	bS	1.3	3200	92	18
Sunlight Lake	bF	15.0	-	100	10

[a] wS = white spruce, tA = trembling aspen, bS = black spruce, bF = balsam fir, wB = white birch

Lookout District, disclosed 51% and 44% shoot mortality, respectively. Shoot damage averaged 17% on 89% of the trees in the three black spruce seedling seed orchards near Skurban and Goodie lakes in Sioux Lookout District and 19% on 72% of the trees in the Vermeersch black spruce seedling orchard near Bark Lake, Ignace District.

Light mortality of early-instar spruce budworm larvae was observed in some host stands throughout the area of frost damage. Also, mature larvae were observed feeding on cold-damaged foliage but it is not known if the budworm completed their life cycle on the frost-damaged foliage. Because the frost damage was so variable, its impact on populations of the spruce budworm is expected to be minimal.

Wind

Thunderstorms and accompanying strong winds in early May travelling northeast across Lake of the Woods caused approximately 53 ha of blowdown in the form of broken tops and uprooted trees. The area of damage occurred west of Hwy 71 and south of Caliper Lake in Claxton Township, Fort Frances District. The affected trees averaged 22 cm DBH and the species affected, in order of number of trees damaged, were jack pine, trembling aspen and white birch.

SPECIAL SURVEYS

White Spruce Plantations

A special survey of planted white spruce was conducted at 12 locations in 1987 (Table 17). Four areas were selected from each of the following height categories: 0.5 m to 2 m, 2.1 m to 6.0 m and > 6.0 m. The sample size was 150 trees and a random sampling procedure was used. The plantations were assessed to detect the presence and impact of the following selected insects, diseases and abiotic damage:

Insects: spruce budworm, spruce coneworm (*Dioryctria reniculelloides* Mut. & Mun.), yellowheaded spruce sawfly, white pine weevil and spruce shootworms (*Zeiraphera* spp.).

Diseases: Armillaria root rot, spruce needle rust, spruce cone rust (*Chrysomyxa pirolata* [Körn.] Winter), spruce broom rust (*Chrysomyxa arctostaphyli* Dietel) and dwarf mistletoe (*Arceuthobium pusillum* Peck.).

Abiotic Damage: Frost

Except for yellowheaded spruce sawfly, white pine weevil, spruce cone rust, spruce broom rust and dwarf mistletoe, all the selected pests were found in at least one plantation.

Miscellaneous insects, diseases or abiotic damage not specifically designated as part of the survey were also assessed when encountered. No miscellaneous disease or abiotic damage was recorded in the present survey; however, several miscellaneous insects were detected but associated damage was light. They include:

Eastern blackheaded budworm - *Acleris variana* (Fern.)
Chameleon caterpillar - *Anomogyna elimata* (Gn.)
White triangle leafroller - *Clepsis persicana* (Fitch)
European spruce sawfly - *Gilpinia hercyniae* (Htg.)
Balsam fir sawfly - *Neodiprion abietis* complex
Ragged sprucegall adelgid - *Pineus similis* (Gill.)

Summary of Pest Problems

The spruce budworm was the insect most commonly found in the survey as it was recorded at 10 of the 12 locations examined. Between 38% and 100% of the trees were affected, and accompanying foliar damage as high as 85% was noted in the 1-ha Centennial Plantation in Red Lake District.

Table 17. Summary of the results of a white spruce plantation survey conducted at 12 locations in the Northwestern Region in 1987 (counts based on the examination of 150 randomly selected treed at each location).

Location	Avg ht of trees (m)	Estimated trees per ha	Estimated area affected (ha)	Spruce budworm		Spruce coneworm		Spruce shootworms	Spruce galls
				Trees attacked (%)	Defoliation (%)	Trees attacked (%)	Defoliation (%)	Trees attacked (%)	Trees affected (%)
Dryden District									
Britton Twp	2.5	5000	25	100	5.6	0	0	0	0
Deer Lake Rd	1.5	2990	0.4	100	2.4	0	0	0	0.7
Rugby Twp	1.3	1200	1.0	100	49.0	0	0	0	0
Fort Frances District									
Kingsford Twp	4.4	1500	1.5	43.3	1.0	0	0	0	6
McCrosson Twp	6.1	2990	15.0	0	0	0	0	0	17
McCrosson Twp	12.0	2990	5.0	0	0	0	0	0	1.3
Ignace District									
Dawe clonal orchard	0.7	-	5.0	38.0	1.0	0	0	0	0
Shrimp Lake	3.0	1800	20.0	100	11.5	6.7	1	0	0
Red Lake District									
Byshe Twp	6.1	4000	3.0	55	5	0	0	89.3	
Centennial Plantation	6.1	3000	1.0	100	85	0	0	0	0
Snake Falls	1.1	3900	5.0	52.7	1.0	0	0	0	
Sioux Lookout District									
Lac Seul, Tramp Bay	5.0	1200	5.0	100	6.5	0	0	0	0

(cont'd)

Table 17. Summary of the results of a white spruce plantation survey conducted at 12 locations in the Northwestern Region in 1987 (counts based on the examination of 150 randomly selected trees at each location) (concl.).

Location	Avg ht of trees (m)	Estimated trees per ha	Estimated area affected (ha)	Frost		Needle Rust		Armillaria root rot
				Trees affected (%)	Foliar damage (%)	Trees affected (%)	Foliar damage (%)	Trees affected (%)
Dryden District								
Britton Twp	2.5	5000	25	100	16.2	0	0	0
Deer Lake Rd	1.5	2990	0.4	0	0	0	0	0
Rugby Twp	1.3	1200	1.0	100	2.3	0	0	0
Fort Frances District								
Kingsford Twp	4.4	1500	1.5	50	1.0	0	0	0
McCrosson Twp	6.1	2990	15.0	0	0	0	0	0
McCrosson Twp	12.0	2990	5.0	0	0	0	0	0
Ignace District								
Dawe clonal orchard	0.7	-	5.0	100	81.0	0.7	1	0
Shrimp Lake	3.0	1800	20.0	100	51.0	1.3	1	0
Red Lake District								
Byshe Twp	6.1	4000	3.0	0	0	100	1	0
Centennial Plantation	6.1	3000	1.0	100	10	0	0	0
Snake Falls	1.1	3900	5.0	100	10	82	1	0.7
Sioux Lookout District								
Lac Seul-Tramp Bay	5.0	1200	5.0	100	44	55.3	1	0

Low numbers of the spruce coneworm, responsible for damage to the current year's growth and cones, were recovered from 3-m-tall trees in a 20-ha plantation in the Shrimp Lake area, Ignace District.

Light shoot damage typical of shootworms was recorded on 89.3% of the trees in a 3-ha plantation in Byshe Township, Red Lake District.

Spruce galls capable of causing twig mortality were found in four plantations, three in Fort Frances District and one in Dryden District, but the incidence was light.

Frost was the most prevalent and damaging agent of the infectious and non-infectious diseases. Damage was recorded at eight locations and shoot mortality averaged 26.9% over all.

A high incidence of needle rust was recorded in three of the five areas in which it was detected but accompanying foliar damage was only 1%.

Recent whole-tree mortality of 0.7% caused by Armillaria root rot was recorded on the survey plots in a small plantation of 1.1-m-tall trees near Snake Falls, Red Lake District.

White Spruce Seed and Cone Pests

A collection of 100 current white spruce cones was taken during the last week of July from a minimum of three trees in two 20-year-old white spruce plantations, one in McCrosson Township, Fort Frances District, and the other in Byshe Township, Red Lake District. The collection was made to detect and assess insect and disease damage and determine the impact of each on seed production. The cones were submitted to the Great Lakes Forestry Centre for dissection. The results indicated that 31% and 84% of the cones were damaged at the plantations in McCrosson and Byshe townships, respectively, and that several cone insects were responsible for accompanying seed loss of 27% and 31% (Table 18). No diseases were encountered but the responsible insect agents and a brief description of associated damage are given below:

Spruce seed moth, *Cydia strobilella* (L.)= *youngana* (Kft.) - These larvae feed almost entirely on the seeds.

Spruce cone gall midge, *Dasineura canadensis* Felt - The larvae form galls in the cone scales and, unless this gall is touching the seed, the damage is usually minimal.

Spruce cone axis midge, *Dasineura rachiphaga* Tripp - The seeds are not attacked directly by the larvae but the connective tissue is damaged, and this interrupts the nutrient supply to the developing seeds.

Spruce cone looper, *Eupithecia mutata* Pears. - It is considered to be an insignificant, solitary cone feeder

Spruce cone maggot, *Lasiomma anthracinum* (Czerny) - This insect destroys developing seed by constructing a spiral feeding tunnel through the seed-bearing regions of the cone.

Seed midge, *Resseliella* sp. - The larvae feed on the scale surfaces within the cones.

Lepidopterous larvae - Although neither plantation was within the area moderately to severely infested by the spruce budworm, their close proximity makes it likely that the damage caused by lepidopterous larvae was in fact caused by spruce budworm.

Damage caused by unknown factors - As is implied, the cause of damage to the cones, insect or mechanical, was unknown.

Table 18. Summary of white spruce seed and cone damage at two locations in the Northwestern Region.

Location	No. of cones examined	Damaged cones (%)	Seed loss within damaged cones (%)	Principal cause of seed loss and no. of cones attacked
Fort Frances District				
McCrosson Twp	100	31	27	Lepidoptera (23) *Lasiomma anthracinum* (8) *Dasineura rachiphaga* (3) Damage caused by unknown factors (2) *Dasineura canadensis* (1)
Red Lake District				
Byshe	100	84	31	*Lasiomma anthracinum* (81) Lepidoptera (4) *Cydia strobilella* (2) *Resseliella* sp. (2) *Eupithecia mutata* (1) Damage caused by unknown factors (1)

Black Spruce Seedling Seed Orchards

Surveys were carried out at each of the 11 black spruce seedling orchards in the Northwestern Region in 1987. Quantitative data were recovered in connection with four specific pest problems at the tree improvement sites (Table 19).

Spruce budworm was detected in all the seed orchards, where up to 86.7% of the trees were infested, but in all assessments the associated damage was less than 2%. Control measures (application of the chemical Orthene) were initiated against this pest on 25 May in the Beauregard seed orchard.

Damage by the white pine weevil was evident on the survey plots in nine of the 10 orchards evaluated. It was observed off plots in the Beauregard seed orchard survey. From 0.7% to 12.7% of the trees were infested, with the highest numbers being recorded in the Manion Lake seed orchard. Infested leaders were hand pruned and destroyed by OMNR staff in all of the orchards.

Recent whole-tree mortality caused by Armillaria root rot was detected in each of the 11 black spruce seedling orchards. From 0.7% to 10.0% of the trees were affected, with levels of 5.3%, 6.7%, 8.7% and 10.0% being recorded in the Goodie Lake South, Morson, Ferguson, and Minnesabic seed orchards, respectively.

An average of 71% of the trees were attacked by frost in the 11 seed orchards, although associated damage was light at several locations. Assessment in the four areas with the highest foliar damage in the Vermeersch, Goodie Lake North, Goodie Lake South and Skurban Lake orchards revealed that 84.6% of the trees were affected and accompanying shoot mortality was 17.5%.

Pinewood Nematode, *Bursaphelenchus xylophilus* (Steiner & Buhrer) Nickle

The pinewood nematode is a newly recognized pest in Canada. It was first identified in 1982 in Manitoba. Surveys for *B. xylophilus* were initiated in Ontario in 1980 but positive identification was not made until 1984. The first collection in the Northwestern Region was made in 1985.

The pinewood nematode is recognized as a serious pest problem in some countries. In Canada, however, the nematode has been associated with dead or dying trees stressed by other factors.

The pinewood nematode may be transported by *Monochamus* spp. bark beetles. The nematodes enter the respiratory system of the adult sawyer beetle after the beetle has completed its life cycle within a tree. The nematodes gain entrance to the vascular system of other trees via adult

Table 19. Summary of the results of surveys conducted at 11 black spruce seedling seed orchards in the Northwestern Region in 1987 (counts based on the examination of 150 randomly selected trees at each location).

Location	Avg ht of trees (m)	Spruce budworm		White pine weevil	Armillaria root rot	Frost	
		Trees attacked (%)	Defoliation (%)	Leaders attacked (%)	Trees attacked (%)	Trees attacked (%)	Foliar damage (%)
Dryden District							
Melgund Twp	1.2	49.3	1.0	-	2.0	96.7	5.7
Fort Frances District							
Manion Lake	1.2	60.3	1.0	12.7	0.7	100	3.6
Morson Twp	1.1	5.3	1.0	2.0	6.7	68.9	1.0
Ignace District							
Ferguson	0.9	22.7	1	2.7	8.7	53.3	1.0
Vermeersch	1.1	74.0	1	0.7	1.3	72.0	19.1
Kenora District							
Minnesabic	1.3	81.3	2.0	0.7	10.0	71.3	1.2
Ulster La	1.2	82.0	2.0	1.3	0.7	25.3	0.8
Red Lake District							
Beauregard	1.0	6.7	1.0	0[a]	1.3	28.0	1.0
Sioux Lookout District							
Goodie Lake North	1.1	81.0	1.0	2.0	0.7	87.0	17.0
Goodie Lake South	1.3	82.0	1.0	2.7	5.3	87.3	16.5
Skurban Lake	1.3	86.7	1.0	1.3	0.7	92.0	17.5

[a] observed off plots

sawyer beetle feeding or ovipositing and, once in the vascular system, they multiply, disrupting nutrient flow.

There are two forms of the pinewood nematode, the "r" and the "m" forms, distinguished by the shape of the female's tail. The "r" form is found mainly in pine while the "m" form is believed to be characteristic of spruce and fir. In 1987, as part of a province-wide program, sampling emphasis was on white spruce, black spruce and balsam fir so that it could be determined whether the "m" form was specific to these three species. In all, six balsam fir, five black spruce, two white spruce and two jack pine exhibiting symptoms of the presence of nematodes (e.g., sawyer beetle activity) were sampled. The "m" form was recovered from sample trees at five locations. Nematodes were found in recently killed black spruce near Pike Lake, Ignace District, and near Corallen Lake, Red Lake District. The "m" form was also found in balsam fir that had been dead for less than one year near Snake Falls, Red Lake District, and in McAree and Drayton townships, Sioux Lookout District.

Acid Rain National Early Warning System (ARNEWS)

The three ARNEWS plots in the Northwestern Region are part of a nationwide network of monitor plots established for the purpose of detecting changes in forest trees, vegetation and soil. Various tree species are represented on the plots: jack pine, trembling aspen and white birch at the Dance Township location, Fort Frances District; jack pine only at the plot in Mafeking Township, Dryden District; black spruce and jack pine near Sandel Lake, Block 10, Sioux Lookout District. In 1987, at least two visits were made to each plot. For each tree, quantitative and qualitative data were recovered on branch and crown condition, current insect- or disease-related defoliation, woody tissue damage, cone or seed damage and acid rain symptoms. Ground vegetation was also examined and collected, as certain ground plants are sensitive indicators of changes in acidity. Soil pits were dug on each plot and samples were submitted for analysis. There were no visible signs of damage by airborne pollutants in any of the plots; however, damage caused by the following agents was recorded: spruce needle rust, frost, hypoxylon canker (*Hypoxylon mammatum* [Wahl.] J.H. Miller), jack pine budworm and spruce budworm.

Gypsy Moth Pheromone Traps

Two pheromone baited traps were set out at the nine provincial parks in the region as well as at Minaki Lodge to detect the presence of gypsy moth, a pest responsible for moderate-to-severe defoliation of 12,678 ha of forest in the southern part of the province in 1987. The traps are part of a much larger national trapping program, and are deployed at campgrounds because of the nature of the pest. The female gypsy moth cannot fly and as a result lays her eggs in late summer on any object on or close to the ground, such as camper trailers and boats. The eggs can hatch in the early spring on a recreational vehicle far removed from the original egg-laying site.

Pheromone trapping in the Northwestern Region was initiated in 1984 by the Canadian Forestry Service. No adult moths were captured until 1987, when a single moth was trapped in Rushing River Provincial Park. A more intensive trapping program will take place in 1988 in Rushing River Provincial Park to determine if more gypsy moth are present.

Climatic Data

Temperature and precipitation have a great deal of influence on the presence and development of insects and diseases. Daily and monthly summaries can aid in the prediction of insect development or the occurrence of abiotic conditions such as frost or drought. Table 20 summarizes weather data at three locations in the region.

Table 20. Summary of mean temperature and total precipitation at three locations in the Northwestern Region in 1987.

Location	Month	Mean temperature (°C)		Deviation from normal (°C)	Total precipitation (mm)		Deviation from normal (mm)
		Normal[a]	Actual		Normal[a]	Actual	
Sioux Lookout Airport	January	-19.4	-13.4	+6.0	36.0	19.0	-17.0
	February	-15.7	-7.2	+8.5	26.8	26.8	-0.8
	March	-8.3	-3.4	+4.9	35.0	28.8	-6.2
	April	1.4	7.5	+6.1	45.2	8.7	-36.5
	May	9.2	11.8	+2.6	65.8	61.2	-4.6
	June	15.2	17.8	+2.6	91.7	48.2	-43.5
	July	18.3	18.9	+0.6	93.7	112.2	+18.5
	August	16.6	16.5	-0.1	88.3	127.7	+39.4
	September	10.7	12.6	+1.9	81.6	35.9	-45.7
	October	4.7	2.1	-2.6	64.9	45.8	-19.1
	November	-5.3	-3.0	+2.3	49.9	44.1	-5.8
	December	-15.1	-9.7	+5.4	33.7	30.5	-3.2
Kenora Airport	January	-18.5	-12.3	+4.2	28.2	17.3	-10.9
	February	-14.4	-6.2	+8.2	23.0	22.6	-0.4
	March	-7.1	-2.7	+4.4	30.1	36.1	+6.0
	April	2.7	9.4	+6.7	41.9	0.2	-41.7
	May	10.5	13.9	+3.4	57.3	70.8	+13.5
	June	16.1	18.9	+2.8	83.4	60.7	-22.7
	July	19.2	20.3	+1.1	91.8	101.4	+9.6
	August	17.6	17.5	-0.1	85.9	82.7	-3.2
	September	11.6	14.0	+2.4	69.2	25.0	-44.2
	October	5.6	3.1	-2.5	40.7	33.0	-7.7
	November	-4.6	-1.7	+2.9	40.4	26.7	-13.7
	December	-14.1	-8.4	+5.7	31.2	17.8	-13.4

(cont'd)

Table 20. Summary of mean temperature and total precipitation at three locations in the Northwestern Region in 1987 (concl.).

Location	Month	Mean temperature (°C)		Deviation from normal (°C)	Total precipitation (mm)		Deviation from normal (mm)
		Normal[a]	Actual		Normal[a]	Actual	
Fort Frances Airport	January	-16.9	-12.0	+4.9	30.6	37.0	+6.4
	February	-13.1	-5.0	+8.1	22.7	25.0	+2.3
	March	5.7	1.5	+4.2	31.6	28.8	-2.8
	April	3.8	8.1	+4.3	48.5	3.2	-45.3
	May	11.0	12.9	+1.9	71.2	95.4	+24.2
	June	16.4	17.6	+0.8	101.7	26.6	-75.1
	July	19.2	19.6	+0.4	103.6	193.4	+89.8
	August	17.7	16.7	-1.0	82.6	66.4	-16.2
	September	12.2	13.2	+1.0	83.8	66.8	-17.0
	October	6.6	4.1	-2.5	50.9	28.0	-22.9
	November	-3.2	-0.6	+2.8	36.8	16.7	-20.1
	December	-12.4	-7.6	+4.8	31.8	12.0	-19.8

[a] Normal temperature and precipitation are based on the period 1951-1980.

APPENDICES

Table A1. Northwestern Region - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1987, and infestation forecasts for 1988.

Location	Host	Estimated defoliation in 1987 (%)	No. of egg masses per 9.29 m^2 of foliage	Infestation forecasts for 1988[a]	Accumulated damage[b]
Dryden District (28 locations)					
Aerobus Lake	bF	94	402	S	3
Aubrey Twp	bF	93	413	S	3
Beaverhouse Lake	bF	83	300	S	2
Brownridge Twp	bF	43	360	S	2
Cedar Lake	bF	79	563	S	3
Cliff Lake	wS	5	786	S	0
Dore Lake	bS	7	97	M-S	0
Eagle Lake - E. side	bF	83	311	S	3
- Meridian Bay	bF	92	244	S	1
- Meridian Bay	bS	31	147	M-S	2
Forest Lake	bF	95	527	S	3
Ingall Lake	bF	86	278	S	2
Kekekwa Lake	bF	44	330	S	2
Melgund Twp - SPAc	bS	6	0	0	0
Mutrie Twp - Eagle River	wS	62	719	S	2
Rugby Twp	bF	63	289	S	3
Smellie Twp - Blue Lake P.P.	bF	78	557	S	2
Southworth Twp	bF	77	78	M-S	1
	bS	9	141	M-S	1
Tadpole Lake	bF	59	603	S	2
	bS	12	83	M-S	0
Thaddeus Lake	bF	95	265	S	3
Tustin Twp	bF	83	335	S	3
Wabaskang Lake - MacLeod Bay	wS	56	216	S	1
Wabigoon Lake - Contact Bay	wS	17	179	M-S	1
Wapageisi Lake	bF	72	446	S	2
Washeibemaga Lake	bF	33	127	M-S	2
Zealand Twp - Aaron Prov. Pk	bF	88	729	S	3
Fort Frances District (24 locations)					
Bear Pass	bF	34	981	S	2
Big Sawbill Lake	bF	63	159	M-S	2
Boffin Lake	bF	35	454	S	2
Carleton Lake	bF	58	256	S	2
Claxton Twp - Caliper Lake Prov. Pk	bF	44	256	S	2

(cont'd)

Table A1. Northwestern Region - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1987, and infestation forecasts for 1988 (cont'd).

Location	Host	Estimated defoliation in 1987 (%)	No. of egg masses per 9.29 m^2 of foliage	Infestation forecasts for 1988[a]	Accumulated damage[b]
Fort Frances District (concl.) (24 locations)					
Dance Twp	wS	2	0	0	0
Entwine Lake	bF	59	362	S	2
Eric Lake	bF	24	196	M-S	2
Jackfish Lake	bF	87	1038	S	2
Kaiarskons Lake	bF	41	148	M-S	2
Katimiagamak Lake	bF	90	315	S	2
Kawawia Lake	bF	5	111	M-S	3
Lawrence Lake	bS	6	196	S	2
Makomesut Lake	bF	6	57	M	2
Manion Lake Rd					
- Hillyer Creek	bF	2	619	S	9
- near Seed Orchard	bF	5	28	L-M	6
Manitou Stretch	bF	8	55	M-S	8
McCrosson Twp					
- Lake of the Wood P.P.	wS	0	41	L-M	0
Pipestone Lake	bF	82	258	S	7
Potts Twp	bF	0	16	L-M	0
Rainy Lake					
- Ash Bay	bF	63	367	S	3
- McDonald Inlet	bF	29	236	M-S	3
Vickers Lake	bF	10	91	M-S	2
Ignace District (22 locations)					
Bark Lake	bF	48	288	S	3
Basket Lake	bF	72	1192	S	3
Bell Lake	bF	68	525	S	3
Bertrand Twp	bF	4	0	0	0
Campus Lake	bF	78	776	S	4
Cecil Lake	bF	90	260	S	3
Dewan Twp	bF	24	174	S	2
Gour Twp	bF	86	260	S	3
Hook Lake	bF	67	568	S	4
Ilsley Twp - Raleigh Lake	bF	22	389	S	3
Kukukus Lake	bF	70	236	S	3
Microwave Tower Rd - Impact Plot	bS	2	0	0	1

(cont'd)

Table A1. Northwestern Region - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1987, and infestation forecasts for 1988 (cont'd).

Location	Host	Estimated defoliation in 1987 (%)	No. of egg masses per 9.29 m^2 of foliage	Infestation forecasts for 1988[a]	Accumulated damage[b]
Ignace District (concl.) (22 locations)					
Sandbar Lake Prov. Pk					
- Stand 705	bF	56	395	S	3
- Stand 719	bF	81	264	S	3
- Stand 739b	bF	8	40	L-M	1
- Stand 740b	bF	14	64	M-S	1
Selwyn Lake	bF	33	335	S	2
Shikag Lake	bF	91	395	S	2
Smirch Lake	bF	65	326	S	5
Sturgeon Lake - Granite Bay	bF	62	219	S	2
- North Arm	bF	9	34	L-M	1
Vista Lake	bF	60	49	M	1
Kenora District (28 locations)					
Cameron Lake - Stand 265	bF	46	250	S	2
Chase Lake	bF	69	1669	S	3
Cygnet Lake	wS	53	2889	S	2
Devonshire Twp	bF	73	983	S	2
Dowswell Lake	bF	53	435	S	2
English River Rd - Stand 8	bF	91	232	S	3
Forgie Twp - Rush Bay Rd	bF	47	324	S	1
Godson Twp	bF	8	69	M-S	2
Lennan Lake	bF	95	803	S	2
Mayburn Rd - Stand 102	bF	64	300	S	2
Maynard Lake	bF	93	288	S	3
Paintpot Lake	bF	93	331	S	3
Pelican Pouch Lake	bF	62	261	S	2
Pellatt Twp - Sandy Lake	bF	88	275	S	2
Rickaby Lake	bF	91	652	S	2
Rowan Lake	bF	95	2050	S	3
	bS	13	936	S	0
Rushing River Prov. Pk	bF	41	497	S	1
Sand Lake - Stand 73	wS	75	3135	S	1
Snowshoe Lake	bF	61	134	M-S	2
Stephen Lake - Stand 220	bF	28	336	S	1
Tetu Lake	bF	88	513	S	3
Toothpick Lake	bF	91	546	S	2
Tourist Lake	bF	81	1180	S	3
Tweedsmuir Twp - Stand 146	bF	88	269	S	3

(cont'd)

Table A1. Northwestern Region - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1987, and infestation forecasts for 1988 (cont'd).

Location	Host	Estimated defoliation in 1987 (%)	No. of egg masses per 9.29 m^2 of foliage	Infestation forecasts for 1988[a]	Accumulated damage[b]
Kenora District (concl.) (28 locations)					
Umfreville Lake - East	bF	74	756	S	2
Willingdon Twp - Stand 139	bF	89	1058	S	2
- Sioux Narrows Prov. Pk	bF	24	295	S	2
Red Lake District (19 locations)					
Baird Twp - Stand 162	bF	11	57	M-S	1
Bateman Twp - East Bay	bF	12	12	L	2
Bowerman Twp	bF	37	335	S	1
Chukuni Lake Rd	bF	4	102	M-S	2
Conifer Lake	bF	42	81	M-S	2
Ear Falls	bF	88	911	S	2
Flundra Lake	bF	11	118	M-S	1
Knott Twp	bF	19	23	L-M	1
Lac Seul - Farewell Bay	bF	88	256	S	2
Longlegged Lake Rd	bF	63	153	M-S	1
Moar Lake	bF	42	1338	S	4
Mulcahy Twp	bF	73	357	S	2
Pakwash Lake	bF	76	332	S	1
Pakwash Prov. Pk - Group Camp	bF	34	420	S	2
- Nature Trail	bF	4	35	L-M	1
- Trailer Camp	bF	26	117	M-S	2
Sturgeon Lake	bF	31	294	S	0
Unexpected Lake	bF	94	520	S	2
Whitemud Lake	bF	82	854	S	2
Sioux Lookout District (26 locations)					
Aerofoil Lake	bF	12	39	L-M	1
Camp 19 Rd	bF	89	275	S	2
Carling Lake	bF	5	8	L	0
Deception Lake	bF	53	362	S	2
Drayton Twp	bF	27	340	S	2
Factor Twp	bF	88	109	M-S	3
Jackknife Lake - Stand 131	bF	90	553	S	3
Kinmewin Lake - Stand 410	bF	72	107	M-S	1

(cont'd)

Table A1. Northwestern Region - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1987, and infestation forecasts for 1988 (concl.).

Location	Host	Estimated defoliation in 1987 (%)	No. of egg masses per 9.29 m^2 of foliage	Infestation forecasts for 1988[a]	Accumulated damage[b]
Sioux Lookout District (concl.) (26 locations)					
Lac Seul					
- Black Bay (Stand 40)	bF	66	43	L-M	2
- Merritt Bay	bF	29	163	M-S	1
- Whitefish Bay	bF	63	222	S	1
- Windigo Point	bF	61	445	S	2
Mascara Lake	bF	14	33	L-M	1
McAree Twp - Stand 42	bF	81	431	S	2
Ojibway Prov. Pk					
- Butterfly Lake	bF	54	246	S	3
- Entrance[d]	bF	60	354	S	2
- Terry Lake Trail	bF	33	190	M-S	3
Pickerel Twp - Impact Plot	bF	75	293	S	2
	wS	80	348	S	2
	bS	11	9	L	1
Savant Lake - NE Arm	bF	19	7	L	0
- S Arm	bF	13	10	L	0
Sunlight Lake	bF	83	304	S	2
Waf Lake	bF	16	32	L-M	1
Wapesi Lake - Stand 470	bF	59	242	M-S	2
Wapesi River	bF	25	122	M-S	1

[a] S = severe, M = moderate, L = light, 0 = nil

[b] Accumulated Damage

Code	Categories	
0	undamaged	
1	light damage:	< 25% total defoliation; usually one season of severe defoliation
2	moderate damage:	25% to 60% total defoliation; 2 or 3 seasons of severe defoliation
3	severe damage:	60% to 80% total defoliation; 3 to 5 seasons of severe defoliation; will recover
4	moribund or dying:	80% to 100% total defoliation; crowns grey in appearance; 50 cm to 150 cm of top dead or bare
5	less than 25% of stand dead	
6	25% to 50% of stand dead	
7	50% to 70% of stand dead	
8	more than 70% of stand dead	
9	less than 25% of stand dead; no significant (0-25%) defoliation for several years	
+	25% to 50% of stand dead; no significant defoliation for several years	
-	51% to 70% of stand dead; no significant defoliation for several years	

[c] SPA - Seed Production Area

[d] Aerially spray with *B.t.* in 1987

Table A2. Northwestern Region - Jack Pine Budworm: Summary of defoliation estimates and egg-mass counts in 1987 and infestation forecasts for 1988 on jack pine.

Location	Estimated defoliation 1987 (%)	Total no. of egg masses on six 61-cm branch tips	Standard infestation forecasts for 1988[a]	Modified infestation forecasts for 1988[a]
Dryden District (42 locations)				
Aerobus Lake - Stand 126	14	2	L	L
Atikwa Lake - Canal Bay	5	2	L	L
Basin Lake - Stand 91	26	2	L	L
Breithaupt Twp - Bailey Lake[b]	28	10	H	L
- Stand 449	33	4	M	L
Britton Twp - Stand 301	8	4	M	L
Camp Robinson Rd - 2.2 km	25	0	N	N
- 12.3 km	13	3	M	L
Devlin Lake - Block 6, Stand 411[c]	10	0	N	N
Docker Twp - Block 21[c]	38	0	N	N
Eagle Lake - Niven Bay, Stand 85	9	13	H	L
Fluke Lake	26	3	M	L
Glider Lake - Block 22[c]	8	3	M	L
Kekekwa Lake	25	1	L	L
Keynote Lake	9	7	H	L
Lac Seul - Route Bay, Block 26[c]	5	0	N	N
Langton Twp - Nixon Lake[b]	42	3	M	L
- Long Lake[b]	35	2	L	L
Little Clay Lake	7	1	L	L
Melgund Twp - Stand 379	8	0	N	N
McIlraith Twp - Stand 59	10	0	N	N
Mutrie Twp[b]	31	0	N	N
- Impact Plot	28	2	L	L
Queer Rock Lake - Stand 15	79	2	L	L
Rawlinson Creek - Stand 217	1	0	N	N
Redvers Twp - Stand 51	33	2	L	L
- N. of Quibell	34	0	N	N
Rowell Twp - Stand 4	19	3	M	L
Rugby Twp	26	0	N	N
Shultz Lake - Stand 21	7	0	N	N
Smellie Twp[b]	61	4	M	L
- Block 20[c]	44	5	M	L
- Blue Lake Prov. Pk	61	2	L	L
Stokes Twp - Stand 96	25	7	H	L
Thaddeus Lake	18	6	H	L
Tools Lake	5	1	L	L
Tustin Twp - Fiesta Lake	19	2	L	L
Vaughan Lake - Block 27[c]	7	0	N	N

(cont'd)

Table A2. Northwestern Region - Jack Pine Budworm: Summary of defoliation estimates and egg-mass counts in 1987 and infestation forecasts for 1988 on jack pine (cont'd).

Location	Estimated defoliation 1987 (%)	Total no. of egg masses on six 61-cm branch tips	Standard infestation forecasts for 1988[a]	Modified infestation forecasts for 1988[a]
Dryden District (concl.) (42 locations)				
Wabigoon Twp[b]	16	4	M	L
Wapagessi Lake	1	0	N	N
Winage Lake	37	0	N	N
Zealand Twp - Tree nursery	7	0	N	N
Fort Frances District (30 locations)				
Ash Lake[c]	5	1	L	L
Bat Lake	27	7	H	L
Bearpaw Lake - Stand 25	3	0	N	N
Bernadine Lake	4	0	N	N
Beynon Lake	11	0	N	N
Bliss Lake	8	0	N	N
Claxton Twp	6	0	N	N
Devils Cascade	4	0	N	N
Dogfly Lake	20	1	L	L
Doman Lake	12	0	M	N
Eltrut Lake - Stand 80	5	0	N	N
Entwine Lake - Stand 328	2	0	N	N
Gussie Lake - Stand 286	8	2	L	L
Halkirk Twp	6	0	M	N
Heron Lake	2	0	N	N
Highrock Lake - Stand 212	6	0	M	N
Jackfish Lake - Stand 266	11	0	N	N
Jones Lake - Stand 17	4	0	M	N
Konigson Lake	20	1	L	L
Loonhaunt Lake - Stand 305	9	1	L	L
Lost Axe Lake	30	0	N	N
Mainville Lake	0	0	N	N
Makomesut Lake - plantation	0	0	N	N
Manion Lake - seed orchard	5	0	M	N
Mathieu Twp - Stand 214	0	0	N	N
Otukamamoan Lake - Stand 63	20	2	L	L
Otukamamoan Lake - Stand 292	9	0	N	N
Pipestone Lake	6	0	M	N
Scattergood Lake	5	0	N	N
Turtle River - plantation	5	0	M	N

(cont'd)

Table A2. Northwestern Region - Jack Pine Budworm: Summary of defoliation estimates and egg-mass counts in 1987 and infestation forecasts for 1988 on jack pine (cont'd).

Location	Estimated defoliation 1987 (%)	Total no. of egg masses on six 61-cm branch tips	Standard infestation forecasts for 1988[a]	Modified infestation forecasts for 1988[a]
Ignace District (14 locations)				
Basket Lake	40	0	N	N
Beak Lake	13	1	L	L
Bradshaw Twp - Stand 130	28	13	H	L
Cecil Lake	25	0	N	N
Dewan Twp - Stand 250	14	2	L	L
Downhill Lake	18	3	M	L
Ignace Twp	17	1	L	L
McNevin Twp	9	3	M	L
Paddy Lake	25	0	N	N
Revell Twp - E. of Basket Lake Rd	35	1	L	L
Revell Twp - W. of Basket Lake Rd	5	1	L	L
Revell Lake	43	1	L	L
Sandbar Lake - Stand 762	24	0	N	N
Suzanne Lake	2	1	L	L
Kenora District (46 locations)				
Arrow Lake - Stand 139	33	3	M	L
Atikwa Lake - Stand 281	29	0	N	N
Barras Lake - Stand 22	23	2	L	L
Beach Lake - Block 13, Stand 162[c]	6	2	L	L
Broderick Twp	3	0	N	N
Coyle Twp - Block 29[c]	12	1	L	L
Devonshire Twp - Stand 25	5	0	N	N
- Block 46, Stand 491[c]	30	3	M	L
Dryberry Lake - Block 52, Stand 36[c]	63	4	M	L
- Block 58, Stand 61[c]	16	0	N	N
- Stand 136	22	1	L	L
Ewart Twp - Block 24[c]	5	1	L	L
Flora Lake - Block 53[c]	2	1	L	L
Forgotten Lake - Block 8[c]	0	1	N	N
Gidley Twp	37	2	L	L
Grassy Narrows	6	1	L	L
Gundy Twp - Block 20[c]	8	1	L	L
Haycock Twp - Block 32[c]	4	0	N	N
Helder Lake	7	1	L	L

(cont'd)

Table A2. Northwestern Region - Jack Pine Budworm: Summary of defoliation estimates and egg-mass counts in 1987 and infestation forecasts for 1988 on jack pine (cont'd).

Location	Estimated defoliation 1987 (%)	Total no. of egg masses on six 61-cm branch tips	Standard infestation forecasts for 1988[a]	Modified infestation forecasts for 1988[a]
Kenora District (concl.) (46 locations)				
Highwind Lake - Stand 125	38	0	N	N
Jackmine Twp	11	0	N	N
Jaffray Twp	6	0	N	N
Kirkup Twp - Block 41[c]	54	2	L	L
Knickerbocker Inlet - Stand 254	11	0	N	N
Lemay Twp - Block 36[c]	5	3	M	L
- Block 39[c]	17	0	N	N
MacNicol Twp	13	0	N	N
McMeekin Twp - Block 38[c]	17	3	M	L
Minaki	11	0	N	N
Mongus Lake - Block 55, Stand 477[c]	13	1	L	L
Northwest Bay - Block 57[c]	8	0	N	N
Oak Lake - Stand 118	6	2	L	L
Oak Lake - Stand 161	11	0	N	N
Puzzle Lake - Stand 87	5	0	N	N
Rainmaker Lake - Stand 51	18	3	M	L
Redditt Twp - Impact Plot	16	0	N	N
Roger Lake	10	4	M	L
Sand Lake - Stand 18	24	1	L	L
Snook Lake	13	0	N	N
Sydney Lake - Stand 115	8	2	L	L
Umfreville Lake - West	5	0	N	N
Wareagle Lake - Block 27[c]	1	0	N	N
White Dog	19	0	N	N
Wonderland Lake	5	2	L	L
Work Twp	32	2	L	L
Yellow Girl Bay - Stand 245	21	0	N	N
Red Lake District (49 locations)				
Baird Twp - 3 km Suffel L. Rd	5	0	N	N
- 6 km Suffel L. Rd., Stand 187	4	2	L	L
Bateman Twp	18	1	L	L
Bigshell Lake	3	0	N	N
Bluffy Lake	32	0		N
Borel Lake - Stand 221	19	0	N	N
Boughton Lake - Stand 204	82	8	H	L

(cont'd)

Table A2. Northwestern Region - Jack Pine Budworm: Summary of defoliation estimates and egg-mass counts in 1987 and infestation forecasts for 1988 on jack pine (cont'd).

Location	Estimated defoliation 1987 (%)	Total no. of egg masses on six 61-cm branch tips	Standard infestation forecasts for 1988[a]	Modified infestation forecasts for 1988[a]
Red Lake District (cont'd) (49 locations)				
Carroll Lake	7	0	N	N
Celt Lake	62	11	H	L
Coli Lake - Block 6, Stand 407[c]	30	10	H	L
Confusion Lake - Stand 117	12	1	L	L
Corallen Lake	25	1	L	L
Dixie River - Stand 171	3	0	N	N
Dolphin Lake	61	10	H	L
Emarton Lake	15	2	L	L
Flundra Lake	31	2	L	L
Haggart Lake	3	0	N	N
Hanton Lake	24	17	H	L
Hanton Lake	68	21	H	L
Heyson Twp - Stand 74	6	0	N	N
Iriam Lake Rd - Stand 90	8	0	N	N
Joyce Lake - Block 11A, Stand 71[c]	16	3	M	L
Killala Twp - Stand 171	5	0	N	N
Kirkness Lake - Stand 14	46	2	L	L
Knott Twp	32	1	L	L
Little Vermilion Lake - Stand 36	40	5	M	L
Longlegged Lake Rd Km 30.8	6	1	L	L
Nungesser Creek - Block 1, Stand 202[c]	3	3	M	L
Odin Lake - Stand 441	35	3	M	L
Offer lake	7	5	M	L
Paull Lake	6	0	N	N
Peall Lake	88	10	H	L
Pedlar Lake - Stand 425	68	5	M	L
Pineneedle Lake	2	1	L	L
Primok Lake - Stand 504	24	3	M	L
Pringle Lake	76	22	H	L
Rathouse Lake - Block 7, Stand 397[c]	6	0	N	N
Red Lake - East Bay	22	4	M	L
Reigate Lake - Stand 36	22	3	M	L
Sidace Road - Stand 253	35	4	M	L
Skinner Twp - Narrow Lake	41	4	M	L
Snakeweed Lake	15	3	M	L
Stormer Lake - Stand 150	17	5	M	L
Sumach Lake - Stand 484	3	0	N	N

(cont'd)

Table A2. Northwestern Region - Jack Pine Budworm: Summary of defoliation estimates and egg-mass counts in 1987 and infestation forecasts for 1988 on jack pine (concl.)

Location	Estimated defoliation 1987 (%)	Total no. of egg masses on six 61-cm branch tips	Standard infestation forecasts for 1988[a]	Modified infestation forecasts for 1988[a]
Red Lake District (concl.) (49 locations)				
Trout Lake - Stand 37	9	3	M	L
- Caskie Bay - Stand 304	16	6	H	L
Valhalla Lake - Stand 362	12	7	H	L
Wagin Lake	10	4	M	L
Wenasaga Lake	15	0	N	N
Sioux Lookout District (18 locations)				
Aerofoil Lake	21	4	M	L
Altimeter Lake - Stand 21	3	0	N	N
Birmingham Lake	7	0	N	N
Goodie Lake - Impact Plot	30	0	N	N
- Impact Plot 60	8	0	N	N
Greenside Lake	66	4	M	L
Gull Lake - Stand 28	14	9	H	L
Horseshoe Lake	18	0	N	N
Hudson	49	2	L	L
Kathlyn Lake - Stand 291	5	0	N	N
Lac Seul - Canoe Bay	11	0	N	N
- Coones Bay	3	0	N	N
Pelican Lake - Stand 255	8	1	L	L
Root Lake - Stand 646	5	1	L	L
Sunlight Lake	21	0	N	N
Upper Wapesi Lake - Stand 95	12	0	N	N
Vaughan Lake - Stand 56	20	1	L	L
Vermilion River Rd	10	0	N	N

[a] N = nil, L = light, M = moderate, H = heavy

[b] Special population assessment plots

[c] Aerially sprayed with *B.t.* in 1987